

**Test Fishery Observations as Indicators of the Ratio of
Sockeye to Chum Salmon Harvested in Commercial
Fisheries of the South Unimak and Shumagin Islands
Areas, June 2004**

by

Ivan W. Vining

May 2005

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative		fork length	FL
deciliter	dL	Code	AAC	mid-eye-to-fork	MEF
gram	g	all commonly accepted		mid-eye-to-tail-fork	METF
hectare	ha	abbreviations	e.g., Mr., Mrs., AM, PM, etc.	standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D., R.N., etc.	Mathematics, statistics	
meter	m			<i>all standard mathematical</i>	
milliliter	mL	at	@	<i>signs, symbols and</i>	
millimeter	mm	compass directions:		<i>abbreviations</i>	
		east	E	alternate hypothesis	H _A
		north	N	base of natural logarithm	<i>e</i>
		south	S	catch per unit effort	CPUE
		west	W	coefficient of variation	CV
		copyright	©	common test statistics	(F, t, χ^2 , etc.)
		corporate suffixes:		confidence interval	CI
		Company	Co.	correlation coefficient	
		Corporation	Corp.	(multiple)	R
		Incorporated	Inc.	correlation coefficient	
		Limited	Ltd.	(simple)	r
		District of Columbia	D.C.	covariance	cov
		et alii (and others)	et al.	degree (angular)	°
		et cetera (and so forth)	etc.	degrees of freedom	df
		exempli gratia		expected value	<i>E</i>
		(for example)	e.g.	greater than	>
		Federal Information		greater than or equal to	≥
		Code	FIC	harvest per unit effort	HPUE
		id est (that is)	i.e.	less than	<
		latitude or longitude	lat. or long.	less than or equal to	≤
		monetary symbols		logarithm (natural)	ln
		(U.S.)	\$, ¢	logarithm (base 10)	log
		months (tables and		logarithm (specify base)	log ₂ , etc.
		figures): first three		minute (angular)	'
		letters	Jan,...,Dec	not significant	NS
		registered trademark	®	null hypothesis	H ₀
		trademark	™	percent	%
		United States		probability	P
		(adjective)	U.S.	probability of a type I error	
		United States of		(rejection of the null	
		America (noun)	USA	hypothesis when true)	α
		U.S.C.	United States	probability of a type II error	
			Code	(acceptance of the null	
		U.S. state	use two-letter	hypothesis when false)	β
			abbreviations	second (angular)	"
			(e.g., AK, WA)	standard deviation	SD
				standard error	SE
				variance	
				population	Var
				sample	var
Weights and measures (English)					
cubic feet per second	ft ³ /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
nautical mile	nmi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				
Time and temperature					
day	d				
degrees Celsius	°C				
degrees Fahrenheit	°F				
degrees kelvin	K				
hour	h				
minute	min				
second	s				
Physics and chemistry					
all atomic symbols					
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
(negative log of)					
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY MANUSCRIPT NO. 05-03

**TEST FISHERY OBSERVATIONS AS INDICATORS OF THE RATIO OF
SOCKEYE TO CHUM SALMON HARVESTED IN COMMERCIAL
FISHERIES OF THE SOUTH UNIMAK AND SHUMAGIN ISLANDS
AREAS, JUNE 2004**

by

Ivan W. Vining
Division of Commercial Fisheries, Kodiak

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

May 2005

The Fishery Manuscript series was established in 1987 for the publication of technically-oriented results of several years' work undertaken on a project to address common objectives, provide an overview of work undertaken through multiple projects to address specific research or management goal(s), or new and/or highly technical methods. Fishery Manuscripts are intended for fishery and other technical professionals. Fishery Manuscripts are available through the Alaska State Library and on the Internet: <http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm> This publication has undergone editorial and peer review.

*Ivan W. Vining,
Alaska Department of Fish and Game, Division of Commercial Fisheries,
211 Mission Road, Kodiak, Alaska 99615, USA*

This document should be cited as:

Vining, I. W. 2005. Test fishery observations as indicators of the ratio of sockeye to chum salmon harvested in commercial fisheries of the South Unimak and Shumagin Islands Areas, June 2004. Alaska Department of Fish and Game, Fishery Manuscript No.05-03, Anchorage.

The Alaska Department of Fish and Game administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information please write to ADF&G, P.O. Box 25526, Juneau, AK 99802-5526; U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington, VA 22203 or O.E.O., U.S. Department of the Interior, Washington DC 20240.

For information on alternative formats for this and other department publications, please contact the department ADA Coordinator at (voice) 907-465-6077, (TDD) 907-465-3646, or (FAX) 907-465-6078.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	ii
LIST OF FIGURES.....	iii
LIST OF APPENDICES	vii
ABSTRACT	1
INTRODUCTION.....	1
METHODS.....	2
Data Collection.....	2
Data Analysis.....	3
Specific Comparisons	4
T-tests Between Test Fisheries and Commercial Fisheries.....	4
Frequency Distribution Comparisons	5
T-tests Conducted Using Data Collected From Test Fishery Vessels During the Commercial Fishery	5
T-tests Conducted Using Data Collected From Test Fishery Vessels During the Entire June Fishery.....	6
Squared Ranks Test	6
Sample Size of Test Fishery Analysis.....	6
RESULTS.....	7
Data Collection.....	7
South Unimak and Shumagin Islands June Fishery Summary	8
ADF&G Statistical Area 284-90.....	8
ADF&G Statistical Area 285-20.....	8
ADF&G Statistical Areas 284-90 and 285-20	8
South Unimak Area	8
South Unimak and Shumagin Islands Areas.....	8
Data Analysis.....	9
T-tests Between Test Fisheries and Commercial Fisheries.....	9
Frequency Distributions.....	9
Comparisons With First Closure, June 16	9
Comparisons With Second Closure, June 21.....	11
Comparisons With Third Closure, June 26	12
T-tests Conducted Using Data Collected From Test Fishery Vessels During the Commercial Fishery	14
T-tests Conducted Using Data Collected From Test Fishery Vessels During the Entire June Fishery.....	14
Squared Ranks Test	14
Test Fisheries Sample Size Analysis	15
DISCUSSION.....	15
CONCLUSIONS	17
REFERENCES CITED	18
TABLES AND FIGURES.....	19
APPENDIX A: SAMPLING FORM.....	75

LIST OF TABLES

Table	Page
1. Date and time of fishing periods in the June South Unimak Fishery, 2004.	20
2. The catch (sockeye and chum salmon) and sockeye proportions for each set, as well as the daily mean, median, standard deviation and total. Also the average catch and sockeye proportion and the associated standard error of each for the three South Unimak test fishery days, June 16, 21, and 26, 2004.	21
3. Estimated sockeye proportion, and number of sets for the test fishery vessels during the commercial fishery, June 17-20 and June 22-25, 2004.	22
4. Sockeye proportion in the commercial fishery the day before the closures, the day after the closures, and the two days combined, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	23
5. Significance of one-sided t-tests between the sockeye proportions in the test fisheries and commercial fishing fleet the day before the closures, the day after the closures, and the two days combined, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	24
6. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 17, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	25
7. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 18, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	25
8. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 19, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	26
9. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 20, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	26
10. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 24, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	27
11. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions from the test fishery, when all six test fish samples were assumed to be independent samples of the fishery, and the commercial June fishery (June 7-29), for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	27

LIST OF TABLES (Continued)

Table	Page
12. Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions from the test fishery vessels catches from both the test fishery and commercial fishery, and sockeye proportion from the commercial fishery for the June fishery (June 7-29), for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.	28
13. Sample size estimates for an α -level of 0.05, with different variance estimates from the test fishery, and varying levels of detectable differences, d , for sockeye proportions between the test fishery on closures and the commercial fishery on adjacent days.	28
14. Sample size estimates for an α -level of 0.05, with varying sockeye proportion variance estimates from the test fishery and commercial fishery, and varying levels of detectable differences, d , for sockeye proportions between samples and the June fishery.	28

LIST OF FIGURES

Figure	Page
1. Map of the South Unimak and Shumagin Islands June fisheries areas.	29
2. Map of set locations during the test fisheries, June 2004.	30
3. Catch by location for Vessel A during the test fisheries June 2004.	31
4. Catch by location for Vessel B during the test fisheries June 2004.	32
5. Sockeye proportions from Vessel A catches by day from June 16 to June 21, 2004.	33
6. Sockeye proportions from Vessel B catches by day from June 16 to June 26, 2004.	33
7. Commercial catch of sockeye and chum salmon only from ADF&G Statistical Area 284-90, by day from June 2004.	34
8. Sockeye proportion in the commercial catch from ADF&G Statistical Area 284-90, by day from June 2004.	34
9. Commercial catch of sockeye and chum salmon only from ADF&G Statistical Areas 284-90 and 285-20 combined, by day from June 2004.	35
10. Sockeye proportion in the commercial catch from ADF&G Statistical Areas 284-90 and 285-20 combined, by day from June 2004.	35
11. Commercial catch of sockeye and chum salmon only from the South Unimak Area, by day from June 2004.	36
12. Sockeye proportion in the commercial catch from the South Unimak Area, by day from June 2004.	36
13. Commercial catch of sockeye and chum salmon only from the South Unimak and Shumagin Islands Areas, by day from June 2004.	37
14. Sockeye proportion in the commercial catch from the South Unimak and Shumagin Islands Areas, by day from June 2004.	37
15. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	38

LIST OF FIGURES (Continued)

Figure	Page
16. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	39
17. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	40
18. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	41
19. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	42
20. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	43
21. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	44
22. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	45
23. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	46
24. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	47
25. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	48
26. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	49
27. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.....	50

LIST OF FIGURES (Continued)

Figure	Page
28. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.	51
29. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of ADF&G Statistical Area 284-90, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	52
30. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Area 284-90, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	53
31. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch from vessels that caught 150 or more fish for ADF&G Statistical Area 284-90, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	54
32. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	55
33. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	56
34. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	57
35. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	58
36. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	59
37. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	60
38. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	61
39. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	62

LIST OF FIGURES (Continued)

Figure	Page
40. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.....	63
41. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.	64
42. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial drift gillnet catch of ADF&G Statistical Area 284-90, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.	65
43. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Area 284-90, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.....	66
44. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak Area, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.	67
45. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak Area, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.	68
46. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.....	69
47. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.....	70
48. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.....	71
49. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.....	72
50. Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.	73

LIST OF APPENDICES

Appendix	Page
A1. Sampling form used during the South Unimak test fisheries in June 2004.	76

ABSTRACT

This study was conducted to test the reliability of the ratio of sockeye to chum salmon reported on commercial fish tickets using data collected from a test fishery. This study also tested whether or not data from the observed test fisheries can provide reliable, independent estimates of the ratio of sockeye to chum salmon harvested commercially in the South Unimak and Shumagin Islands June fishery. In 2004, a total of three test fisheries were conducted using two seine vessels each during closures between commercial fishing periods in the Cape Pankof area. Observers were assigned to each of the two vessels to monitor and sample the test fisheries. From this information, the proportion of sockeye salmon in the combined sockeye and chum salmon catch (referred to as the sockeye proportion) for each day was estimated and compared to the overall sockeye proportions reported on commercial fish tickets on days adjacent to each closure day. One-sided single-sample t-tests were used to determine if the sockeye proportion was significantly lower in the test fishery than reported on the fish tickets. From the t-test analyses, the sockeye proportion was not significantly ($P>0.05$) lower in the test fishery than fish ticket estimates from the commercial fishery on days immediately adjacent the test fishery. The sockeye proportions from the test fisheries compared to the sockeye proportion from the entire June fishery were also not significantly lower ($P>0.05$) in most tests.

Further analysis of the data with frequency distributions revealed high variability in the sockeye proportion both between days and between vessels. The sockeye proportion in the test fishery was usually within the range of variation for the frequency distributions estimated from commercial harvest data. The test fishery sockeye proportions tended to be similar to the sockeye proportion from the commercial catch for either the day before the closure or the day after, but not both. Therefore, the sockeye proportion from one day may not be similar to the next day, and comparing the sockeye proportion from a test fishery during a closure to the sockeye proportion from the commercial catch on adjacent days may not be appropriate. Further, sample size analyses indicated that to accurately evaluate possible differences in the sockeye proportion between a test fishery and commercial fishery would require a larger sample size of test fishing vessels per gear type and area.

Key words: sockeye salmon, chum salmon, *Oncorhynchus*, Area M, South Unimak, Shumagin Islands, Alaska Peninsula.

INTRODUCTION

This report documents the collection and analysis of data on the proportion of sockeye salmon *Oncorhynchus nerka* in the combined sockeye and chum salmon *O. keta* catch for the South Unimak and Shumagin Islands Area, during June 7-29, 2004. This proportion ($S/(S+C)$) was used, for ease of analysis, as a surrogate for the more commonly used ratio of sockeye to chum salmon harvests ($S:C$). The objective of this study was to evaluate the reliability of the proportion of sockeye salmon reported on the commercial fish tickets, using estimates collected from a test fishery during adjacent closed periods. Also, the study was to determine the utility of using test fisheries during commercial fishery closures to estimate the sockeye to chum salmon ratio expected for commercial fishery openings. Commercial harvesters performed the test fishing under the direction of ADF&G during closed periods between fishery openers, with the objective of obtaining estimates of the catch composition expected for the commercial fishery. Supplemental to the main objectives, a sample size analysis was conducted to determine how many test fishing vessels would be needed to better test for differences in the sockeye salmon proportion of the combined sockeye and chum salmon catch between a test fishery and fish tickets from the commercial fishery.

The South Unimak and Shumagin Islands are part of Area M, which is subdivided into the North Alaska Peninsula and the South Alaska Peninsula. The South Peninsula extends from Kupreanof Point to Scotch Cap on Unimak Island. The specific area for the study was in the Southwestern and South Unimak Districts (Figure 1). Three gear types are used during the South Peninsula June fisheries: purse seines (seines), drift gillnets, and set gillnets. All three gear types are used

in the South Unimak June fishery, whereas only seines and set gillnets are used in the Shumagin Islands June fishery (Burkey et al. 2005). This document uses the term “June fisheries” when referring to the combined South Unimak and Shumagin Islands June commercial salmon fisheries.

Five species of salmon occur and are harvested in the South Peninsula area, however this report is principally concerned with sockeye and chum salmon in the June fisheries. Most of the catch during the June fishery is sockeye salmon (Burkey et al. 2005). The majority of the sockeye and chum salmon harvest (> 60% of each species during 1993-2002) in the South Unimak June fishery is harvested by the drift gillnet fleet. The seine fleet harvests the majority of sockeye and chum salmon caught in the Shumagin Islands June fishery. Unless otherwise specified, all references to “catch” in this report are to the combined catch of sockeye and chum salmon only.

In the South Peninsula, chum salmon usually do not enter local spawning streams until late July or August (Burkey et al. 2005). For this reason, chum salmon harvested in the South Peninsula June fishery have been considered migrant stocks. Migration patterns of chum and sockeye salmon passing through the South Peninsula area have been studied, using tagging (Eggers et al. 1991) and genetic (Seeb et al. 1997) techniques. These studies attributed a substantial proportion (38%-60%) of the chum salmon harvested in the June fisheries to Northwest Alaska spawning stocks, ranging from Bristol Bay to Kotzebue.

The Alaska Board of Fisheries (BOF) has implemented a number of measures to limit the harvest of chum salmon in these fisheries. From 1986 through 2000 the June fisheries were managed with an upper limit on the number of chum salmon that could be harvested; when reached the fisheries would close for the remainder of June. Prior to the 2001 June fishery, the BOF eliminated regulations specifying an upper limit on the chum harvest, and adopted new regulations that specified specific open and closed “windows”. Fishery closures or extensions of fishing periods after June 24 were determined by the sockeye to chum salmon ratio. For the 2004 June fisheries, the BOF expanded the open “windows” and removed restrictions based upon the total catch of chum salmon or the ratio of sockeye to chum salmon (Burkey et al. in press).

Immediately prior to commencement of fishing activities, ADF&G agreed to conduct two studies during the 2004 June fisheries to evaluate the accuracy of the species composition recorded on fish tickets. The study reported on here attempted to address questions regarding the accuracy of fish tickets in reporting species composition as it occurred on the fishing grounds and prior to deliveries. A subsequent report will address accuracy of fish tickets in reporting species composition at the time of delivery at a processing facility (Vining 2005).

METHODS

DATA COLLECTION

Three one-day test fisheries were conducted using two seine vessels in the Ikatan Bay (ADF&G Statistical Area 284-90) and Otter Cove (ADF&G Statistical Area 285-20) Sections on the south side of the Alaska Peninsula (Figures 1 and 2), during closure periods between commercial fishery openings in the South Unimak June fishery in 2004 (Table 1). To distinguish the two test fishing vessels, they are referred to “Vessel A” and “Vessel B”. The skipper and crew were instructed to duplicate normal fishing practices and they were allowed to choose where to fish near Cape Pankof. If possible, eight sets were made on each day of a test fishery by each vessel.

An observer, from a private contracting firm, was assigned to each vessel and collected data on the location and catch for each set during the test fisheries. For each day, the observer recorded date, vessel name, and the observer's name on the sample form (Appendix A1). For each set, the observer recorded location name, latitude and longitude, start and stop time of the set, number of sockeye and chum salmon caught, the ratio of sockeye to chum salmon, the total estimated catch (including all species of salmon), tide condition, basic weather and sea conditions, and comments. Data were later entered into a database at the ADF&G Regional Office in Kodiak.

The observers remained onboard the test fishery vessels during the commercial fishery openings between test fisheries. During these commercial fishing periods they opportunistically collected data from these vessels' commercial harvests using the same procedures and forms as during the test fisheries, except the observers did not sample every set nor record all information for sets sampled. Sometimes less than half the sets were sampled for a given commercial fishing day. This provided limited information on the variation in catch and sockeye proportions between sets during the commercial fishery.

The observers were not able to count fish in some sets, especially when sets were large. This was true during the test fisheries and the commercial fishery. Observers used various methods to estimate total number of fish and species composition when the entire set was not counted. It was not possible to evaluate the error in the observer estimates of catch or catch composition. Due to differences in the methodologies for estimating catch and catch composition between the observers and the vessel crew, the daily estimates of catch and catch composition from the observers were not exactly the same as those recorded on the fish tickets for the test fisheries or the commercial fishery. Throughout the analyses, observer estimates were used for sockeye proportions, because the methods used by the observers to estimate catch and catch composition were documented and because catches from adjacent days were sometimes combined on fish tickets during the commercial fishery. The only time the sockeye proportions from fish tickets were used in preference to observer reports was when the observer sampled less than half the commercial fishing sets. The fish ticket values were used for the estimate of total catch during the commercial fishery when only a single day's total was recorded.

DATA ANALYSIS

The ratio of sockeye to chum salmon was transformed, for analysis purposes, to the proportion of sockeye salmon in the combined sockeye and chum salmon catch. Proportions were used instead of ratios for three reasons. First, ratios can suffer large changes with only small differences in species counts. For example, a count of 90 sockeye salmon and 10 chum salmon will have a ratio of 9 to 1, while a count of 99 sockeye salmon and 1 chum salmon will have a ratio of 99 to 1. Secondly, when the sample or catch contains only sockeye salmon and no chum salmon, the ratio is infinite regardless of sample or catch size. Lastly, proportions have well defined, regularly used statistical tests and distributions, which make analyses easier to perform and understand (Zar 1996).

Throughout this report "catch" will refer to the combined catch of sockeye and chum salmon only, disregarding the minor incidental harvests of other salmon species when present. Also, throughout this report "sockeye proportion" will refer to the proportion of sockeye salmon in the catch (sockeye and chum salmon only).

The two test fishery vessels were assumed to represent two independent samples during each closed period. A comparison between the sockeye proportion from fish tickets of the commercial

fishery and the sockeye proportion of the test fisheries was needed. However, there was no specific information on the size of individual sets recorded on commercial fish tickets. To compare the test fishery data to the commercial fish tickets, the sampling unit for the test fishery had to be the sockeye proportion for an entire day, with all sets for each vessel and day pooled. Therefore, the sockeye proportion for a day from each test fishery vessel was the sampling unit and, because there were two vessels, there was a sample size of two for each test fishery day.

Specific Comparisons

Several tests and comparisons by gear type and area were conducted between the sockeye proportions from the test fisheries and the commercial fish tickets, in a hierarchical manner. It was assumed that commercial fishery openings the day just before or just after the closures would be best represented by the samples in the test fishery for a specific closure date. The most reasonable comparisons between the test fisheries and the commercial fishery would be between similar gear for a specific area (e.g., seine gear in ADF&G Statistical Area 284-90). However, further comparisons were made to encompass the greater areas fished and the different gear types. This was done to provide comparisons between the test fisheries and the entire commercial fishery of concern, the June fisheries.

Sockeye proportions in test fishery catches were tested and compared to sockeye proportions from the fish tickets of the seine commercial catch for ADF&G Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, the entire South Unimak Area, and the South Unimak and Shumagin Island Areas combined.

The combined seine and drift gillnet catches were also used during tests and comparisons. The combined seine and drift gillnet catches were used for comparisons due to few seine catches in the Cape Pankof area, where the test fisheries were conducted. The sockeye proportions in the test fisheries were tested and compared to the sockeye proportions from fish tickets for the combined commercial seine and drift gillnet catches for ADF&G Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, the entire South Unimak Area, and the South Unimak and Shumagin Island Areas combined.

Set gillnet catches were not used in any comparisons because of known differences in catch performance between set gillnets and the other gear types (Jim McCullough, ADF&G, Westward Region, Kodiak, personal communications).

T-tests Between Test Fisheries and Commercial Fisheries

One-sided single-sample t-tests (Zar 1996) were used to test whether the average sockeye proportions from the test fisheries were significantly ($P < 0.05$) lower than the sockeye proportion reported from the commercial fish tickets. The t-tests were performed for each closure, with a comparison of the sockeye proportions from the test fishery with the sockeye proportion from the commercial fish tickets reported from the day before the closure, the day after the closure, and a combination of the day before and after the closure. Those tests were conducted for the different gear type and area comparisons outlined above.

One-sided t-tests were performed because public concern has been raised that the ratio of sockeye to chum salmon as reported on commercial fish tickets might be too high. Therefore, t-tests were performed to test whether the fish ticket sockeye proportions were higher than the average sockeye proportions from the test fisheries. Using these one-sided t-tests provides more power to discern statistically significant differences (in the one direction of concern) than if two-sided t-tests had been utilized. Single-sample t-tests were performed instead of two-sample t-

tests because the comparison was to the sockeye proportion in the commercial catch: the commercial catch was the population. As such, the best estimate for the sockeye proportion in the commercial catch, for a specific day and gear, was the total number of sockeye salmon caught divided by the total number of sockeye and chum salmon caught as recorded on fish tickets.

Frequency Distribution Comparisons

The t-test has low power (ability to detect a difference when a difference occurs), when the sample sizes are as small as in this study. Therefore, comparisons of frequency distributions were performed to determine whether the sockeye proportions in the test fisheries were reasonably represented in the sockeye proportions from fish tickets of the commercial catch. Frequency distributions are a qualitative, descriptive method that show how often certain sockeye proportions occurred regardless of catch size.

Frequency distributions of the sockeye proportions for deliveries from a specified day were constructed from the commercial fish tickets for the day before a closure, the day after a closure, and the day before and the day after a closure combined. The sockeye proportions in each test fishery were then compared to the various frequency distributions of the sockeye proportions reported by deliveries on fish tickets from the commercial catch. The comparisons were conducted for the different gear types and areas outlined above.

Two frequency distributions were constructed for each comparison: one constructed from all deliveries of commercial catch and the other from only deliveries of commercial catch greater than or equal to 150 fish. A problem with using frequency distributions of sockeye proportions is that the relative size of the catch is not taken into account. In other words, a delivery with a catch of 3 fish has the same influence in a frequency distribution as a delivery with a catch of 300 fish. However, by using all deliveries the number of individual points was maximized to estimate the distribution of the sockeye proportions from the fish tickets of the commercial catch. To lower the effect of deliveries with small catches, further comparisons were conducted with vessels that had deliveries with catches greater than or equal to 150 fish. Deliveries with catches of 150 or more were of a similar magnitude as the daily catches in the test fisheries, and still provided a reasonable estimate of the frequency distribution for the sockeye proportions from the commercial fishery.

T-tests Conducted Using Data Collected From Test Fishery Vessels During the Commercial Fishery

One-sided single-sample t-tests were used to test whether the average sockeye proportion for the test fishery vessels during the commercial fishery was significantly lower than the sockeye proportions from the fish tickets of the total commercial catch for each day when both test fishery vessels were commercial fishing. The tests were conducted for the different gear types and area comparisons outlined above. The reasons for one-sided single-sample t-tests being used were the same as described earlier for comparisons between the test fisheries and commercial fishery.

These t-tests were conducted to provide in-season comparisons between the test fishery vessels and the commercial fishery in general. The t-tests provided daily comparisons between the test fishery vessels and the commercial fleet, instead of the comparison of sockeye proportions on adjacent days. It was assumed that, with observers onboard the test fishery vessels, the observed vessels would be compliant with all rules and regulations during the commercial fishery.

T-tests Conducted Using Data Collected From Test Fishery Vessels During the Entire June Fishery

Two other types of comparisons were made using one-sided single-sample t-tests. First it was assumed that all samples taken during the test fisheries were independent of all others, raising the sample size to six (two vessels for each of three days). The average sockeye proportion from these samples was tested to see if it was significantly lower than the estimated sockeye proportion from the commercial fish tickets of the June fishery (June 7-29). Secondly, the average sockeye proportion of all test fishery vessel catches between June 16 to June 26, including sockeye proportions from the commercial catch, was tested to see whether it was significantly lower than the estimated sockeye proportion from the commercial fish tickets of the June fishery (June 7-29). The tests were conducted for the different gear types and area comparisons outlined above. The reasons for one-sided single-sample t-tests being used were the same as described earlier for comparisons between the test fishery and commercial fishery.

Squared Ranks Test

The squared ranks test for variances (Conover 1980) was used to test if the variance of catch per purse seine set for a test fishing vessel during a day of test fishing was different from the variance for the same vessel during an adjacent day of commercial fishing. The squared ranks test was also used to test for differences between test fishing and commercial fishing adjacent days in the variance of sockeye proportions per purse seine set for a test fishing vessel. The squared ranks test for variances is a nonparametric test similar to the F-test, however unlike the F-test the squared ranks test is not effected by departures from normality. Those tests were done to determine if the individual test fishery vessels were fishing in a manner similar to normal fishing operations. For example, if the sockeye proportion variance on a specific vessel was different between the test fisheries and commercial fishery, this might indicate the vessel was changing fishing locations more or less often to affect the sockeye proportions. The tests were only performed when a test fishery vessel commercially fished on an adjacent day to the test fishery and a sufficient number of sets (> 4) were sampled during the day of commercial fishing. A significant difference between the variances in the test fishery and commercial fishery would indicate that the test fishery might not represent normal commercial fishing operations.

Sample Size of Test Fishery Analysis

The number and length of sets in the commercial fishery is not monitored or reported, nor are they standardized throughout the fleet. Therefore, the sampling unit for our comparisons has been the sockeye proportion per day and vessel. The only way to increase the power of detecting a difference between the sockeye proportion in the commercial fishery and test fisheries is to increase the sample size, that is, the number of test fishery vessels.

The sample size can be calculated as follows (Thompson 1992):

$$n = \frac{t_{n-1}^2 \sigma^2}{d^2}$$

where n is the sample size, t_{n-1} is the value from a Student's t-distribution with a specific α -value, σ^2 is the variance, and d is the difference to be detected in the sockeye proportions of the test fisheries and the commercial fishery. By varying d and assuming various values of σ^2 , different sample sizes were estimated. Three levels were used to detect differences in sockeye proportions between the test fisheries and the commercial fishing fleet: $d = 0.05$, 0.10 , and 0.15 .

The best source to estimate the variance in the sockeye proportion among vessels during days between fishery closures of the June fisheries was the variances estimated from the test fisheries. Variances were estimated for each of the three test fishery periods, and each used as a measure of variance in the sample size analysis.

The evaluation of the sockeye proportion during the June fisheries should not be limited to days adjacent to specific closure periods. Therefore, estimates of sample size were also made assuming samples would be collected throughout the June fisheries. The sample size calculation was the same as above, except that the variance for the sockeye proportion was estimated from the entire June fishery.

There were several data sources that were used to estimate the sockeye proportion variance for the June fishery (June 7 – 29):

- a. the overall variance estimated from the sockeye proportion in the six test fishery catches,
- b. the overall variance estimated from the sockeye proportions in all catches by the test fishery vessels (both test fisheries and commercial fishery),
- c. the variance estimated from the sockeye proportions in the commercial seine catch, for all of June 2004,
- d. the variance estimated from the sockeye proportion in the commercial seine and drift gillnet catch, for all of June 2004.

RESULTS

DATA COLLECTION

The two fishing vessels in the test fisheries fished a total of three days: June 16, 21, and 26. Eight sets were made each day, except for the last day when Vessel A made only seven sets. All sets were made near the Ikatan Peninsula at the southeast tip of Unimak Island, Cape Pankof (Figures 1 and 2).

The catch per set averaged 160 fish for Vessel A and 180 fish for Vessel B. There was considerable variation in number of fish caught per set both during a fishing day and between fishing days (Table 2). The first and third test fishery days, June 16 and 26, had relatively low catches, with only one set a day catching more than 100 fish. On the second test fishery day the catches were much higher, with only one set being less than 100 fish.

There was considerable variation in the sockeye proportions, as well (Table 2). For the first test fishery day there were only two sets that had sockeye proportions greater than 0.80, with a low of 0.28. The second test fishery day had higher sockeye proportions, especially for Vessel A which had sockeye proportions greater than 0.80 for 6 of the 8 sets. On the third test fishery day, the sockeye proportions per set were still greater than 0.80 on over half the sets for Vessel A, however Vessel B had sockeye proportions less than 0.60 for half the sets for that day.

The size of the catch seemed to be partially associated with the areas chosen to fish (Figures 3 and 4). The sockeye proportion per day was variable during the commercial fishery for the two test fishery vessels (Table 3) and throughout the study period (Figures 5 and 6).

SOUTH UNIMAK AND SHUMAGIN ISLANDS JUNE FISHERY SUMMARY

The catch and sockeye proportion varied greatly, between gear types and areas in the June commercial fishery.

ADF&G Statistical Area 284-90

For the ADF&G Statistical Area 284-90, in the South Unimak area immediately east of Cape Pankof, the daily commercial seine catch was generally low ($< 4,000$), and no commercial seine catch occurred after June 23 (Figure 7). The majority of the catch for most days and for the entire June fishery was from commercial drift gillnets. Sockeye proportions tended to be lower for the seine fleet alone as compared to the combined seine and drift gillnet fleet. The general trend in the sockeye proportions from the fish tickets for the commercial seine catch and the combined commercial seine and drift gillnet catch was similar after June 16, but fairly different before June 16 (Figure 8).

ADF&G Statistical Area 285-20

There was very little commercial seine catch in ADF&G Statistical Area 285-20, in the South Unimak area immediately west of Cape Pankof, and almost all of the catch was due to the commercial catch from drift gillnets. There was no fishing by either the seine or drift gillnet fleet in Statistical Area 285-20 after June 22 (Figure 9).

ADF&G Statistical Areas 284-90 and 285-20

Though there was little commercial seine fishing effort in Statistical Area 285-20, it did affect the sockeye proportion in the combined catch of Statistical Areas 284-90 and 285-20 noticeably in mid-June (Figure 10). Overall, the variation in sockeye proportions for the combined commercial seine and drift gillnet catch was less among days within a fishing period than between the last day of one period and the first day of the next period (Figure 10).

South Unimak Area

The total South Unimak seine catch from June 7-17 and June 22-25 was fairly small; however, from June 18-20 and June 27-29 there was an increase in seine catch (Figure 11). The combined seine and drift gillnet catches for the entire South Unimak Area were highest in mid-June. The sockeye proportion from fish tickets of the South Unimak Area had a similar trend as those for Statistical Areas 284-90 and 285-20 combined (Figure 10) from early June to mid-June. However, after mid-June there was a steady increase in the sockeye proportion, dominated by the increase in the sockeye proportion in the seine catch. Also, the sockeye proportions from the commercial seine fleet were usually much lower than the sockeye proportions from the combined commercial seine and drift gillnet fleet from June 7-15. However, the sockeye proportions from the commercial seine fleet were much higher after June 16 (Figure 12).

South Unimak and Shumagin Islands Areas

The South Unimak and Shumagin Islands combined catch does not seem to follow a trend of any kind (Figure 13). There was considerable day to day variability in the seine or combined seine and drift gillnet catch, except in late June when the catch is dominated by the seine catch and was fairly constant between 20,000 and 40,000 fish per day. Commercial seine catch was large and often the dominant component of the combined seine and drift gillnet catch. The sockeye proportion, on the other hand, shows an apparent cyclic trend (up and down) throughout June (Figure 14).

DATA ANALYSIS

T-tests Between Test Fisheries and Commercial Fisheries

The averages of sockeye proportions from the individual test fisheries were not significantly lower ($P > 0.05$) than the sockeye proportions estimated from fish tickets of the commercial fishery for any of the comparisons (Tables 4 and 5). However, there were often large differences between the estimated sockeye proportions in the commercial catch the day before a closure and the day after (Table 4). Results of some tests were close to the significance level criteria (e.g. P-values between 0.08 and 0.10) (Table 5).

Frequency Distributions

There were many comparisons conducted between the daily frequency distributions of the sockeye proportions for deliveries from the commercial fleet and the sockeye proportions from the test fisheries. The sockeye proportion of each vessel was identified on each frequency distribution histogram by individually marked lines. The frequency scale on the y-axis of the frequency distribution histograms varies between graphs.

Comparisons With First Closure, June 16

The average sockeye proportion from the seine commercial catch in the ADF&G Statistical Area 284-90 was 0.60 for the 5 deliveries on June 15 and 0.85 for the 3 deliveries on June 17. The sockeye proportions from the test fishery on June 16 were similar to the sockeye proportions from the seine commercial catch on June 15 and lower than the sockeye proportions from the commercial seine catch on June 17 (Figure 15). The average sockeye proportion from the commercial seine catches of 150 or more fish was 0.56 for the 4 deliveries on June 15 and 0.85 for the 3 deliveries on June 17. Not including commercial catches that were less than 150 fish had little effect on the frequency distribution of the sockeye proportions in the commercial seine catch of Statistical Area 284-90 for this time period (Figure 16).

The average sockeye proportion from the commercial seine and drift gillnet catch in Statistical Area 284-90 was 0.69 for the 21 deliveries on June 15 and 0.84 for the 12 deliveries on June 17. The sockeye proportions from the test fishery were similar to those from the commercial seine and drift gillnet catch on June 15 and lower than those from the commercial seine and drift gillnet catch on June 17 (Figure 17). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.69 for the 19 deliveries on June 15 and 0.82 for the 9 deliveries on June 17. Not including the commercial catches that were less than 150 fish had little effect on the frequency distribution of the sockeye proportions in the commercial seine and drift gillnet catch of Statistical Area 284-90 for this time period (Figure 18).

There was no seine catch in Statistical Area 285-20 after June 14, so no additional comparison for seine catch was conducted for ADF&G Statistical Area 284-90 and 285-20 combined.

The average sockeye proportion from the commercial seine and drift gillnet catch in Statistical Areas 284-90 and 285-20 combined was 0.74 for the 57 deliveries on June 15 and 0.83 for the 31 deliveries on June 17. The sockeye proportions from the test fishery on June 16 were similar but lower than those from the commercial seine and drift gillnet catch on June 15 and June 17 (Figure 19). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.75 for the 55 deliveries on June 15 and 0.82 for the 26 deliveries on June 17. Not including the commercial catches that were less than 150 fish had little effect on the

frequency distribution of the sockeye proportions in the commercial seine and drift gillnet catch for Statistical Areas 284-90 and 285-20 for this time period (Figure 20).

The average sockeye proportion from the commercial seine catch in the South Unimak Area was 0.59 for the 6 deliveries on June 15 and 0.89 for the 6 deliveries on June 17. The sockeye proportions from the test fishery on June 16 were similar to those from the commercial seine catch on June 15 and lower than those from the commercial seine catch on June 17 (Figure 21). When the rest of the South Unimak Area sockeye proportions was added to the sockeye proportions from Statistical Areas 284-90 and 285-20, the number of deliveries doubled, and all of the sockeye proportions from the additional deliveries were above 0.96. The average sockeye proportion from the commercial seine catches of 150 or more fish was 0.56 for the 5 deliveries on June 15 and 0.89 for the 6 deliveries on June 17. Not including the commercial catches that were less than 150 fish had little effect on the frequency distribution of the sockeye proportions in the commercial seine catch for the South Unimak Area for this time period (Figure 22).

The average sockeye proportion from the commercial seine and drift gillnet catch in the South Unimak Area was 0.76 for the 105 deliveries on June 15 and 0.82 for the 65 deliveries on June 17. The sockeye proportions from the test fishery on June 16 were slightly lower than those from the commercial seine and drift gillnet catch on June 15 and lower than those on June 17 (Figure 23). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.76 for the 103 deliveries on June 15 and 0.81 for the 60 deliveries on June 17. Not including the commercial catches that were less than 150 fish had did not change the shape of the frequency distribution of the sockeye proportions in the commercial seine and drift gillnet catch for the South Unimak Area for this time period (Figure 24).

The average sockeye proportion from the commercial seine catch in South Unimak and Shumagin Islands Areas was 0.70 for the 27 deliveries on June 15 and 0.79 for the 29 deliveries on June 17. The sockeye proportion from the test fishery Vessel A during the June 16 test fishery was fairly low compared to those from the commercial seine catch on June 15, however for test fishery Vessel B the sockeye proportion was near the average from the commercial fishery. Both sockeye proportions from the test fishery were lower than most of the sockeye proportions from the commercial seine catch on June 17 (Figure 25). The average sockeye proportion from the commercial seine catches of 150 or more fish was 0.70 for the 26 deliveries on June 15 and 0.80 for the 27 deliveries on June 17. Not including the commercial catches that were less than 150 fish did not change the frequency distribution of the sockeye proportions in the commercial seine catch for the South Unimak and Shumagin Islands Areas for this time period (Figure 26).

The average sockeye proportion from the commercial seine and drift gillnet catch in the South Unimak and Shumagin Islands Areas was 0.76 for the 126 deliveries on June 15 and 0.80 for the 88 deliveries on June 17. The sockeye proportions from the test fishery on June 16 were lower (especially Vessel A) than those from the commercial seine and drift gillnet catch on June 15 and June 17 (Figure 27). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.76 for the 124 deliveries on June 15 and 0.80 for the 81 deliveries on June 17. Not including the commercial catches that were less than 150 fish did not change the frequency distribution of the sockeye proportions in the commercial seine and drift gillnet catch for the South Unimak and Shumagin Islands Areas for this time period (Figure 28).

Comparisons With Second Closure, June 21

The average sockeye proportion from the commercial seine catch in Statistical Area 284-90 was 0.71 for the 3 deliveries on June 20 and 0.80 for the single delivery on June 22. The sockeye proportions from the test fishery on June 21 were similar to those from the commercial seine catch on June 20 and 22 (Figure 29); test fishery Vessel B had nearly the same average as the commercial seine fishery. There were no seine catches on June 20 and 22 less than 150 fish for this area.

The average sockeye proportion from the commercial seine and drift gillnet catch in Statistical Area 284-90 was 0.85 for the 23 deliveries on June 20 and 0.86 for the 29 deliveries on June 22. The sockeye proportions from the test fishery on June 21 were low compared to those from the commercial seine and drift gillnet catch on June 20 and 22 (Figure 30). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.84 for the 18 deliveries on June 20 and 0.86 for the 21 deliveries on June 22. Not including the commercial catches that were less than 150 fish did not change the shape of the frequency distribution of the sockeye proportions in the commercial seine and drift gillnet catch for statistical area 284-90 for this time period (Figure 31).

There was no seine catch in Statistical Area 285-20 for this time period, so no additional comparison for seine catch was conducted for Statistical Area 284-90 and 285-20 combined.

The average sockeye proportion from the commercial seine and drift gillnet catch in Statistical Areas 284-90 and 285-20 was 0.81 for the 45 deliveries on June 20 and 0.86 for the 30 deliveries on June 22. The sockeye proportions from the test fishery on June 21 were similar to those from the commercial seine and drift gillnet catch on June 20, and the sockeye proportion from Vessel A was nearly the same as the average (Figure 32). However, both sockeye proportions from the test fishery were lower than most of the sockeye proportions in the commercial seine and drift gillnet catch for June 22. The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.80 for the 40 deliveries on June 20 and 0.85 for the 22 deliveries on June 22. Not including the commercial catches that were less than 150 fish had little effect on the frequency distribution of the sockeye proportions of the commercial seine and drift gillnet catch for ADF&G Statistical Areas 284-90 and 285-20 combined (Figure 33). However, on June 20, not including the catches of less than 150 fish decreased the average sockeye proportion from the commercial seine and drift gillnet catch below that from the test fishery catch for Vessel A, because one small catch with a high sockeye proportion was eliminated.

The average sockeye proportion from the commercial seine catch in the South Unimak Area was 0.85 for the 11 deliveries on June 20 and 0.94 for the 6 deliveries on June 22. The sockeye proportions from the test fishery on June 21 were fairly low compared to those from the commercial seine catch on June 20 and much lower than those from June 22 (Figure 34). The sockeye proportion from Vessel B of the test fishery on June 21 was lower than any sockeye proportion from the commercial seine catch for June 22. The average sockeye proportion from the commercial seine catches of 150 or more fish was 0.85 for the 11 deliveries on June 20 and 0.89 for the 3 deliveries on June 22. Not including the commercial catches that were less than 150 fish did not change the frequency distribution of the sockeye proportions in the commercial seine June 20 catch for the South Unimak Area (Figure 35a). However, for June 22 catches less than 150 fish comprised half the deliveries; omitting them changed the frequency distribution

considerably, both for that day (Figure 35b) and for the combined frequency distribution of June 20 and 22 (Figure 35c).

The average sockeye proportion from the commercial seine and drift gillnet catch in the South Unimak Area was 0.80 for the 60 deliveries on June 20 and 0.87 for the 35 deliveries on June 22. The sockeye proportions from the test fishery on June 21 were similar but low compared to those from the commercial seine and drift gillnet catch on June 20. However, the sockeye proportions from the test fishery on June 21 were lower than most of those from the commercial seine and drift gillnet catch on June 22 (Figure 36). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.80 for the 55 deliveries on June 20 and 0.86 for the 21 deliveries on June 22. Not including the commercial catches that were less than 150 fish had little affect on the frequency distribution of the sockeye proportions in the commercial seine and drift gillnet catch for the South Unimak Area for June 20 (Figure 37a). However, omitting them for June 22, reduced the number of deliveries in the higher ranges (> 0.95 , Figure 37b).

The average sockeye proportion from the commercial seine catch in the South Unimak and Shumagin Islands Areas was 0.72 for the 33 deliveries on June 20 and 0.67 for the 22 deliveries on June 22. The sockeye proportions from the test fishery on June 21 were similar to the average of that of the commercial seine catch (Figure 38). The average sockeye proportion from the commercial seine catches of 150 or more fish was 0.72 for the 33 deliveries on June 20 and 0.62 for the 19 deliveries on June 22. Not including the commercial catches that were less than 150 fish did not change the frequency distribution of the sockeye proportions in the commercial seine catch for the South Unimak and Shumagin Islands Areas for June 20 (Figure 39a). However, for June 22, all three catches of less than 150 fish had sockeye proportions that ranged from 0.95 to 1.00; omitting them substantially changed the distribution in the high range (Figure 39b). This explains the relatively large (approximately 0.05) decrease in the average sockeye proportion when the catches of less than 150 fish were removed.

The average sockeye proportion from the commercial seine and drift gillnet catch in the South Unimak and Shumagin Islands Areas was 0.76 for the 82 deliveries on June 20 and 0.78 for the 51 deliveries on June 22. The sockeye proportions from the test fishery on June 21 were near the average for the sockeye proportions from the commercial seine and drift gillnet catch on June 20 and 22. The sockeye proportion from Vessel A of the test fishery was slightly above each average, while the sockeye proportion from Vessel B was slightly below each average (Figure 40). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.75 for the 77 deliveries on June 20 and 0.74 for the 40 deliveries on June 22. For June 20, not including the commercial catches that were less than 150 fish did not change the frequency distribution (Figure 41a). However, omitting catches of less than 150 fish reduced the frequency of deliveries with sockeye proportions above 0.80 (Figure 41b).

Comparisons With Third Closure, June 26

There was no commercial seine catch in Statistical Areas 284-90 or 285-20 on the day before or after the closure of June 26. All comparisons for these two statistical areas are with drift gillnet catches only.

The average sockeye proportion from the drift gillnet commercial catch in Statistical Area 284-90 was 0.87 for the 3 deliveries on June 25 and 0.86 for the single delivery on June 27. The sockeye proportions from the test fishery on June 26 were below any sockeye proportion from

the drift gillnet commercial catch for June 25 and 27 (Figure 42). The average sockeye proportion from the drift gillnet commercial catches of 150 or more fish was confidential due to only 2 deliveries on June 25 and 0.86 for the single delivery on June 27. Not including the commercial catches that were less than 150 fish changed the frequency distribution of the sockeye proportions in the drift gillnet commercial catch for statistical area 284-90 on June 25 (Figure 43a), but this would be expected given the small number of deliveries.

There was no drift gillnet catch in Statistical Area 285-20 for this time period, so no additional comparison for drift gillnet catch was conducted for ADF&G Statistical Area 284-90 and 285-20 combined.

The average sockeye proportion from the commercial seine catch in the South Unimak Area was 0.94 from the single delivery on June 25 and 0.98 for the 8 deliveries on June 27. The sockeye proportions from the test fishery on June 26 were well below any sockeye proportions from the commercial seine catch for June 25 and 27 (Figure 44). There were no seine catches less than 150 fish in the South Unimak Area on June 25 and 27.

The average sockeye proportion from the commercial seine and drift gillnet catch in the South Unimak Area was 0.91 for the 5 deliveries on June 25 and 0.96 for the 9 deliveries on June 27. The sockeye proportions from the test fishery on June 26 were below any sockeye proportion from the commercial seine and drift gillnet catch for June 25 and 27 (Figure 45). The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.87 for the 3 deliveries on June 25 and 0.96 for the 9 deliveries on June 27. Not including the commercial catches that were less than 150 fish changed the shape of the frequency distribution on June 25 (Figure 46a). This was not surprising because 2 of the 5 deliveries had less than 150 fish and those also had the highest sockeye proportions in the commercial seine and drift gillnet catches on that day.

The average sockeye proportion from the commercial seine catch in the South Unimak and Shumagin Islands Areas was 0.77 for the 20 deliveries on June 25 and 0.75 for the 25 deliveries on June 27. The sockeye proportions from Vessel A of the test fishery on June 26 were similar to the average of the sockeye proportions from the commercial seine catch for both June 25 and June 27 (Figure 47). However, the sockeye proportion from Vessel B of the test fishery was lower than most of the sockeye proportions of the commercial seine catch for both days. The average sockeye proportion from the commercial seine catches of 150 or more fish was 0.77 for the 20 deliveries on June 25 and 0.76 for the 24 deliveries on June 27. Not including the commercial catches that were less than 150 fish had little effect on the frequency distribution for this time period (Figure 48).

The average sockeye proportion from the commercial seine and drift gillnet catch in South Unimak and Shumagin Islands Areas was 0.79 for the 24 deliveries on June 25 and 0.76 for the 26 deliveries on June 27. The sockeye proportion from Vessel A of the test fishery on June 26 was near the average of the sockeye proportion of the commercial seine and drift gillnet catch for both June 25 and June 27 (Figure 49). However, the sockeye proportion from Vessel B of the test fishery was lower than most of the sockeye proportions of the commercial seine and drift gillnet catch for both June 25 and June 27. The average sockeye proportion from the commercial seine and drift gillnet catches of 150 or more fish was 0.77 for the 22 deliveries on June 25 and 0.77 for the 25 deliveries on June 27. Not including the commercial catches that were less than 150 fish had little effect on the frequency distribution (Figure 50).

T-tests Conducted Using Data Collected From Test Fishery Vessels During the Commercial Fishery

Both test fishery vessels fished in the South Unimak commercial fishery June 17-20 and 24 (Table 3). The average sockeye proportions from the test fishery vessel commercial catches were not significantly lower ($P>0.05$) than those estimated from fish tickets of the commercial catch for any of the comparisons, except one (Tables 6 - 10). On June 17, the average sockeye proportion from the test fishery vessels was significantly lower ($P=0.0462$) than that from the fish tickets of the commercial seine catch in the South Unimak Area. However, the average sockeye proportion from the test fishery vessels was not significantly lower ($P=0.95$) than that from fish tickets of the commercial seine and drift gillnet catch (Table 6).

T-tests Conducted Using Data Collected From Test Fishery Vessels During the Entire June Fishery

When all 6 test fishery catches were assumed to be independent samples of the June commercial fishery, the average sockeye proportion was significantly lower ($P<0.05$) than those estimated from fish tickets of the commercial seine catch for the June fishery (June 7 to June 29), in one of four comparisons (Table 11). The average sockeye proportion from the 6 test fishery samples was significantly lower ($P=0.006$) than that estimated from fish tickets from the South Unimak commercial seine catch.

The average sockeye proportion from the 6 test fishery samples was not significantly lower ($P>0.05$) than that from the combined commercial seine and drift gillnet catch in the June fishery (June 7 to June 29) for Statistical Areas 284-90 and 285-20 combined, and the South Unimak and Shumagin Islands Areas combined. However, the average sockeye proportions from the test fishery catches were significantly lower ($P<0.05$) than those from the combined commercial seine and drift gillnet catch of the June fishery (June 7 to June 29) for Statistical Area 284-90 and the South Unimak Area (Table 11).

A total of 19 test fishery vessel-days were used to compare the sockeye proportion from the test fishery vessel catches (both test fishery and commercial fishery) to the sockeye proportions from fish tickets of the commercial June fishery (June 7 - 29). The average sockeye proportion from the test fishery vessel catches was not significantly lower ($P>0.05$) than that from the commercial fishery fish tickets, except for the commercial South Unimak June seine fishery (Table 12).

Squared Ranks Test

The test between the variances of the test fisheries and commercial fishery, for the test fishery vessels, was difficult because of incomplete data during the commercial fishery. Often there were few sets (< 5) sampled during a commercial fishing day and the observers were never able to sample all the commercial sets when there were more than 5 sets in a day. Due to these constraints, a limited number of tests were performed.

For test fishing Vessel A, one squared ranks test was performed to compare size of catch per set and one to compare sockeye proportions per set. Tested were the variances of the catch and sockeye proportions between June 20 and June 21. Neither the variance in the catch per set nor in the sockeye proportion per set was significantly different ($P>0.20$) between the two days.

For test fishing Vessel B, the variances of the catch per set and the sockeye proportions per set between June 16 and June 17 were tested. The variance in the catch per set between the two days

was significantly different ($P < 0.01$). However, the variance in the sockeye proportions per set was not significantly different ($P > 0.20$) between the two days.

Test Fisheries Sample Size Analysis

Sample size calculations, for a comparison between the sockeye proportion in a test fishery during closures and the commercial fishery during adjacent days, were performed with the variances from individual test fisheries (Table 13). The sample size estimates ranged from 3 to 16 depending on the detectable difference desired and the assumed variance (Table 13).

Sample size calculations, for a comparison between the sockeye proportion from samples taken throughout the commercial fishery and the entire commercial fishery, were estimated using four different variance estimates (Table 14). The recommended sample sizes ranged from 3 to 37 depending on the detectable difference desired and the assumed variance (Table 15). Most of the sample size estimates were between 4 and 11, with higher sample size estimates needed for larger variance estimates and smaller detectable differences.

DISCUSSION

The many methods used to evaluate the reliability and utility of using sockeye proportions measured in test fisheries to describe sockeye proportions in commercial catches led to inconclusive results. The sample size was too low to reliably detect differences between the sockeye proportion in the test fisheries during closures and adjacent commercial fishery openings. The results also indicate that the use of test fishery information obtained during closures may not reflect conditions in the commercial fishery during openings on adjacent days.

The average sockeye proportion in each test fishery (June 16, 21, and 26) was not significantly lower than any of the sockeye proportions in the commercial catch on days adjacent to the closure (Table 5). In fact, it was not uncommon for the average sockeye proportion in the test fishery to be higher than the sockeye proportions in the commercial catch on days adjacent to the closure (Tables 4 and 5). The average sockeye proportions from the test fishery vessels during the commercial fishery were also not significantly lower than the sockeye proportions in the commercial catch for the same day, except once (Tables 6 - 10). However, with only two test fishing vessels and the relatively large variability in sockeye proportions between those two vessels, there was little chance of detecting a significant difference between the sockeye proportions in the test fisheries and commercial fishery.

The average sockeye proportion in the test fishery catches, all days combined, was significantly lower (Table 11) than in the reported commercial seine catch for the June fishery in the South Unimak Area. This was likely due to more commercial seine vessels fishing in the South Unimak area after June 26, especially outside Statistical Areas 284-90 and 285-20 (Figures 11 and 12). This was the only t-test between the test fisheries and commercial seine catch in which the sockeye proportion from the test fishery was ever lower than reported for the commercial seine catch. The single significant difference was further evidence however, that there can be substantial changes in the commercial catch and species composition in a relatively short time period.

The frequency distributions indicated that the sockeye proportions in the test fishery for one or both vessels were usually similar to the average sockeye proportions of the commercial catch for either the day before or after the test fishery (Figures 15-22, 25-26, 29-33, 35-41, 47-50). However, the sockeye proportions from the test fishery were often below the average sockeye

proportion from the commercial catch either the day before or after a closure, especially when compared to the combined seine and drift gillnet sockeye proportions (Figures 15-28, 30-31, 32-37, 42-46). Drift gillnet commercial catch was included in these analyses to provide more catch data for estimating the sockeye proportion in the commercial catch. The graphical comparisons indicate that comparing the sockeye proportion from two seine test fishing vessels to the sockeye proportion in the drift gillnet commercial catch may not be appropriate. The difference between the sockeye proportion in the test fishery and the commercial fishery often became more pronounced when drift gillnet catches were included in the analysis (Figures 15-50).

The average sockeye proportions from the test fishery were significantly lower than those from the combined seine and drift gillnet catch for the June fishery in the Statistical Area 284-90 and the South Unimak Area (Tables 11 and 12). These differences may be due, in part, to the species-specific catch efficiency of the two gear types.

Limited data were available to evaluate whether the test fishery catches and sockeye proportions in the test fishery were consistent with normal commercial fishing operations. The test of variances between adjacent days indicated that the sockeye proportion varied approximately the same amount between the test fishery and commercial fishery. Not surprisingly, the variance of the catch was not always the same between adjacent days. This could be explained by weather, tides or other external variables. The results indicated that the test fishery vessels tended to duplicate their own commercial fishing practices during the test fishery.

There was considerable evidence that comparing the sockeye proportion between adjacent days was not appropriate. Commercial catch and sockeye proportions differed largely in most of the areas considered (Figures 8-14). Some of the largest differences between the sockeye proportions occurred between the day before a closure and the day after a closure. This may be the reason the sockeye proportion in the test fishery catch would seem reasonable for the day before the closure but not for the day after (Figures 15-50). Further evidence that the sockeye proportions from one day should not be compared to adjacent days was the high variability in the daily sockeye proportions for either vessel in the test fishery (Figures 5-6). There seemed to be a cyclic trend in the sockeye proportion over time for the entire South Unimak and Shumagin Island Areas, but even in that time series graph there is substantial difference in the sockeye proportion before and after closures (June 11, 16, 21, and 26, Figure 14). This trend can be partially attributed to the combination of commercial catch from multiple days on single fish tickets.

The results indicated that the sockeye proportion from a test fishery during a closure should not be used as an estimate of the sockeye proportions from a commercial catch on adjacent days. However, if this type of study were to be performed in the future, the sample size would need to be increased, by increasing the number of vessels participating in the test fishery. From the t-tests and graphical comparisons presented here, the sample size of two test fishery vessels was not sufficient for detecting differences in the sockeye proportion between the test fishery and commercial fishery on adjacent days. A minimum sample size of three vessels is needed for a reasonable detection ($d = 0.15$) under most variance scenarios (Table 13). To ensure that a sufficient sample size is available under all variance considerations, a sample size of four or greater is needed. Because variations in the sockeye proportions were significantly greater in comparisons that combined seine and drift gillnet catches than in comparisons with seine catches only, separate estimates should be made for different gear types. A sample of at least four vessels of each gear type should be used. To be able to detect smaller differences ($d < 0.15$) in the

sockeye proportion between the test fishery and commercial fishery, the sample size would need to increase to greater than four vessels per gear type.

The sample size needed for obtaining statistically defensible information on the sockeye proportion in the June commercial catch was estimated at between three and six samples for a detection in the difference between the sockeye proportion in the samples and the commercial fishery of $d = 0.15$ (Table 14). The smaller sample size was calculated from the lowest estimate of variance, which was derived from the test fishery sockeye proportion, and likely underestimates the true variability. A sample size of 5 to 6 would likely have a better chance of detecting the 0.15 difference between the sockeye proportions between the samples and the commercial fishery. However, a detection of 0.15 may not be sufficient. For example, if the average sockeye proportion from the samples obtained during the commercial fishery were 0.65, then the June sockeye proportion in the commercial fishery would need to be greater than 0.80 before significant difference would be possible. If the ability to detect smaller differences is desired, then larger sample sizes would be needed. As with the earlier sample size calculations, separate samples should be collected for each gear type.

Multiple tests and comparisons were conducted between the sockeye proportions from the test fishery and the June fisheries. However, data were collected only in the area near Cape Pankof (Figures 1 and 2). Although there seemed to be some similarities between the sockeye proportions for the different areas, these are not consistent or predictable (Figures 8, 10, 12, and 14). The Cape Pankof area was chosen for the test fishery because there had been considerable effort from both seine and gillnet fishers in past years. In June 2004, there was little effort by the commercial seine fishing fleet until after June 26 (Burkey et al. in press). This further demonstrates the need for a larger sample size to provide information on the multiple areas used by the fishing industry.

The above analyses from the test fishery were performed to evaluate possible bias (higher sockeye proportions in the catch) in the commercial fishing fleet, and not for possible bias of individual vessels. With the large variation in catch and sockeye proportions between vessels and days, it seems unlikely that it would be possible to statistically detect bias on the sockeye proportion recorded for a specific delivery.

Management concerns and actions have often been based on the ratio of sockeye to chum salmon, not the sockeye proportion in the catch. The transformations of ratios to proportions or proportions to ratios are not linear transformations. Therefore, the sample size calculations above for proportions are not directly comparable to sample size calculations necessary for all possible ratios. To estimate the detectable difference and subsequent sample size of any two specific ratios, predetermined ratios would need to be specified, rather than just the difference. For example, to detect a difference between sockeye to chum ratios of 1:1 and 2:1 (e.g., proportions of 0.50 and 0.67, $d = 0.17$), is much different than to detect a difference between sockeye to chum ratios of 2:1 and 3:1 (e.g., proportions of 0.67 and 0.75, $d = 0.08$).

CONCLUSIONS

The comparison of test fishery information to commercial fishery information on adjacent days did not appear to be appropriate. There were many indications that the variation between days can be substantial and unpredictable. Also, results for a single gear type from a specific area will not likely typify a multi-gear fishery over a large area.

For such a test fishery to produce dependable results, there would need to be a substantial increase in the number of vessels and crews participating. There would also need to be representative vessels used from all gear types in all major fishing areas.

REFERENCES CITED

- Burkey, C. E., J. J. Dinnocenzo, S. Dueterloh, and A. R. Shaul. 2005. South Peninsula annual salmon management report, 2004. Alaska Department of Fish and Game, Fishery Management Report No. 05-28, Anchorage.
- Chatfield, C. 1984. The Analysis of Time Series: An Introduction. Chapman and Hall, New York. 286pp.
- Conover, W.J. 1980. Practical Nonparametric Statistics, 2nd ed. John Wiley and Sons, New York. 493pp.
- Eggers, D.M, K. Rowell, and B. Barrett. 1991. Stock composition of sockeye and chum salmon catches in southern Alaska Peninsula fisheries in June. Fishery Research Bulletin No. 91-01, Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau
- Seeb, L.W., P.A. Crane, and E. M. Debevec. 1997. Genetic analysis of chum salmon harvested in the South Unimak and Shumagin Islands June fisheries, 1993-1996. Regional Information Report, 5J97-17, Alaska Department of Fish and Game, Anchorage
- Thompson, S. K. 1992. Sampling. John Wiley and Sons. 343pp.
- Vining, I.W. 2005. An Evaluation on the Accuracy of Sockeye Salmon to Chum Salmon Ratio as Reported From the Commercial Harvest in the June South Unimak and Shumagin Islands Fisheries, 2004. Alaska Department of Fish and Game, Fishery Management Report No. 05-02, Anchorage.
- Zar, J. 1996. Biostatistical Analysis, 3rd Edition. Prentice Hall, Upper Saddle River. 662pp.

TABLES AND FIGURES

Table 1.-Date and time of fishing periods in the June South Unimak Fishery, 2004.

Date	Time	Fishery Action
June 7	6:00 am	Commercial Fishery Opens
June 10	10:00 pm	Commercial Fishery Closes
June 12	6:00 am	Commercial Fishery Opens
June 15	10:00 pm	Commercial Fishery Closes
June 16		Test Fishery
June 17	6:00 am	Commercial Fishery Opens
June 20	10:00 pm	Commercial Fishery Closes
June 21		Test Fishery
June 22	6:00 am	Commercial Fishery Opens
June 25	10:00 pm	Commercial Fishery Closes
June 26		Test Fishery
June 27	6:00 am	Commercial Fishery Opens
June 29	10:00 pm	Commercial Fishery Closes

Table 2.-The catch (sockeye and chum salmon) and sockeye proportions for each set, as well as the daily mean, median, standard deviation and total. Also the average catch and sockeye proportion and the associated standard error of each for the three South Unimak test fishery days, June 16, 21, and 26, 2004.

Vessel	June 16		June 21		June 26	
	Catch	Sockeye Proportion	Catch	Sockeye Proportion	Catch	Sockeye Proportion
Vessel A						
Set 1	3	0.3333	322	0.9441	7	0.8571
Set 2	8	0.6250	111	0.8739	29	0.9310
Set 3	14	0.7857	460	0.9304	42	0.9048
Set 4	15	0.7333	336	0.8988	8	0.3750
Set 5	14	0.5714	444	0.8378	61	0.9180
Set 6	40	0.7750	388	0.6959	33	0.4545
Set 7	35	0.3714	732	0.7732	89	0.6854
Set 8	61	0.5246	438	0.5662	NA ^b	NA ^b
Mean	23.8	0.5900	403.9	0.8150	38.4	0.7323
Median	14.5	0.5982	413.0	0.8559	33.0	0.8571
Standard Deviation	19.7	0.1743	173.6	0.1303	29.2	0.2332
Daily Total ^a	190	0.5895	3,231	0.8007	269	0.7658
Vessel B						
Set 1	14	0.8571	82	1.0000	12	0.9167
Set 2	10	0.4000	525	0.8130	33	0.6667
Set 3	19	0.6316	139	0.6115	42	0.5952
Set 4	34	0.6765	196	0.7245	48	0.4583
Set 5	18	0.2778	212	0.7075	55	0.5273
Set 6	38	0.6579	350	0.4186	118	0.7627
Set 7	109	0.8532	1,000	0.7600	44	0.3409
Set 8	94	0.7128	1,020	0.7206	99	0.6061
Mean	42.0	0.6334	440.5	0.7195	56.4	0.6092
Median	26.5	0.6672	281.0	0.7225	46.0	0.6006
Standard Deviation	38.1	0.2029	377.1	0.1654	35.0	0.1785
Daily Total ^a	336	0.7173	3,524	0.7172	451	0.6075
Vessels Combined						
Vessel Average ^c	263.0	0.6534	3,377.5	0.7602	360.0	0.7414
Standard Error	103.2	0.0639	207.2	0.0418	128.7	0.0791

^a Total catch for the day and sockeye proportion in the total catch for the day

^b There were only seven sets for Vessel A for this day

^c Average of the vessels' Daily Total

Table 3.-Estimated sockeye proportion, and number of sets for the test fishery vessels during the commercial fishery, June 17-20 and June 22-25, 2004.

				Catch Statistics				
Vessel	June 17	June 18	June 19	June 20	June 22	June 23	June 24	June 25
Vessel A								
Estimated Sockeye Proportion	0.8475	0.5641	0.5493	0.6108	NA ^a	NA ^a	0.9632	NA ^a
Sets	6	2	10	10	NA ^a	NA ^a	4	NA ^a
Vessel B								
Estimated Proportion of Sockeye	0.8597	0.8212	0.7584	0.7397	0.6326	0.9574	0.8753	0.5000
Sets	11	4	10	9	5	2	4	2
Vessels Combined								
Average Sockeye Proportion	0.8536	0.6927	0.6538	0.6753	NA ^b	NA ^b	0.9193	NA ^b
Standard Error	0.0061	0.1286	0.1046	0.0644	NA ^b	NA ^b	0.0439	NA ^b

^a Vessel A did not participate in fishery on this date.

^b No average sockeye proportion was estimated since there was only a single test fishery vessel participating in fishery.

Table 4.-Sockeye proportion in the commercial fishery the day before the closures, the day after the closures, and the two days combined, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion near June 16			Commercial Sockeye Proportion near June 21			Commercial Sockeye Proportion near June 26		
	Before Closure	After Closure	Combined	Before Closure	After Closure	Combined	Before Closure	After Closure	Combined
Seine Gear									
Statistical Area 284-90	0.571	0.874	0.721	0.705	0.800	0.716	NA ^a	NA ^a	NA ^a
Statistical Areas 284-90 and 285-20	0.571	0.874	0.721	0.705	0.800	0.716	NA ^a	NA ^a	NA ^a
South Unimak Area	0.557	0.896	0.752	0.775	0.867	0.786	0.939	0.977	0.975
South Unimak and Shumagin Islands Areas	0.741	0.798	0.758	0.658	0.589	0.634	0.740	0.678	0.717
Seine and Drift Gill Net Combined									
Statistical Area 284-90	0.706	0.849	0.747	0.787	0.847	0.806	0.853	0.859	0.856
Statistical Areas 284-90 and 285-20	0.764	0.832	0.781	0.772	0.846	0.788	0.853	0.859	0.856
South Unimak Area	0.766	0.815	0.780	0.777	0.857	0.792	0.901	0.968	0.957
South Unimak and Shumagin Islands Areas	0.756	0.797	0.768	0.681	0.618	0.660	0.742	0.681	0.720

^a No deliveries reported.

Table 5.-Significance of one-sided t-tests between the sockeye proportions in the test fisheries and commercial fishing fleet the day before the closures, the day after the closures, and the two days combined, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	T-test Significance of Sockeye Proportions, near June 16			T-test Significance of Sockeye Proportions, near June 21			T-test Significance of Sockeye Proportions, near June 26		
	Before Closure	After Closure	Combined	Before Closure	After Closure	Combined	Before Closure	After Closure	Combined
Seine Gear									
Statistical Area 284-90	0.7893	0.0898	0.2416	0.7896	0.2526	0.7547	NA ^a	NA ^a	NA ^a
Statistical Areas 284-90 and 285-20	0.7893	0.0898	0.2416	0.7896	0.2526	0.7547	NA ^a	NA ^a	NA ^a
South Unimak Area	0.8131	0.0821	0.1832	0.3844	0.1174	0.3149	0.0966	0.0846	0.0854
South Unimak and Shumigan Islands Areas	0.2005	0.1327	0.1739	0.8751	0.9231	0.8971	0.3122	0.5356	0.3845
Seine and Drift Gill Net Combined									
Statistical Area 284-90	0.2809	0.1006	0.1911	0.3136	0.1413	0.2317	0.1414	0.1369	0.1395
Statistical Areas 284-90 and 285-20	0.1670	0.1095	0.1480	0.4044	0.1417	0.3083	0.1414	0.1369	0.1395
South Unimak Area	0.1638	0.1197	0.1485	0.3700	0.1280	0.2878	0.1128	0.0873	0.0907
South Unimak and Shumigan Islands Areas	0.1774	0.1330	0.1621	0.8442	0.9086	0.8727	0.3045	0.5209	0.3737

^a No deliveries reported.

Table 6.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 17, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 17		T-test Significance for Sockeye Proportion, June 17	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	0.874	0.849	0.0940	0.7131
Statistical Areas 284-90 and 285-20	0.874	0.832	0.0940	0.9131
South Unimak Area	0.896	0.815	0.0462	0.9495
South Unimak and Shumagin Islands Areas	0.798	0.797	0.9651	0.9654

Table 7.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 18, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 18		T-test Significance for Sockeye Proportion, June 18	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	0.812	0.792	0.2618	0.2910
Statistical Areas 284-90 and 285-20	0.812	0.783	0.2618	0.3046
South Unimak Area	0.908	0.803	0.1712	0.2740
South Unimak and Shumagin Islands Areas	0.866	0.800	0.2035	0.2788

Table 8.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 19, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 19		T-test Significance for Sockeye Proportion, June 19	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	0.725	0.734	0.3097	0.2926
Statistical Areas 284-90 and 285-20	0.725	0.789	0.3097	0.2099
South Unimak Area	0.899	0.815	0.1283	0.1832
South Unimak and Shumigan Islands Areas	0.759	0.772	0.2497	0.2303

Table 9.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 20, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 20		T-test Significance for Sockeye Proportion, June 20	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	0.705	0.787	0.3614	0.1670
Statistical Areas 284-90 and 285-20	0.705	0.772	0.3614	0.1873
South Unimak Area	0.775	0.777	0.1829	0.1797
South Unimak and Shumigan Island Areas	0.658	0.681	0.5831	0.4739

Table 10.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions in the test fishery vessels commercial catch and the sockeye proportion in the commercial catch for June 24, for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 24		T-test Significance for Sockeye Proportion, June 24	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	NA ^a	0.909	NA ^a	0.5749
Statistical Areas 284-90 and 285-20	NA ^a	0.909	NA ^a	0.5749
South Unimak Area	0.929	0.914	0.4308	0.5367
South Unimak and Shumagin Islands Areas	0.563	0.578	0.9610	0.9593

^a No deliveries reported

Table 11.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions from the test fishery, when all six test fish samples were assumed to be independent samples of the fishery, and the commercial June fishery (June 7-29), for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 7-29		T-test Significance for Sockeye Proportion, June 7-29	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	0.696	0.778	0.5386	0.0357
Statistical Areas 284-90 and 285-20	0.651	0.765	0.8904	0.0581
South Unimak Area	0.833	0.783	0.0059	0.0304
South Unimak and Shumagin Islands Areas	0.663	0.697	0.8292	0.5275

Table 12.-Sockeye proportion in the commercial catch and significance of one-sided t-tests between the sockeye proportions from the test fishery vessels catches from both the test fishery and commercial fishery, and sockeye proportion from the commercial fishery for the June fishery (June 7-29), for seine gear only, seine and drift gillnet combined, Statistical Area 284-90, Statistical Areas 284-90 and 285-20 combined, South Unimak Area, and South Unimak and Shumagin Islands Areas.

Fishery	Commercial Sockeye Proportion, June 7-29		T-test Significance for Sockeye Proportion, June 7-29	
	Seine	Seine and Drift Gillnet	Seine	Seine and Drift Gillnet
Statistical Area 284-90	0.696	0.778	0.8525	0.0738
Statistical Areas 284-90 and 285-20	0.651	0.765	0.9887	0.1439
South Unimak Area	0.833	0.783	0.0023	0.0576
South Unimak and Shumagin Islands Areas	0.663	0.697	0.9755	0.8455

Table 13.-Sample size estimates for an α -level of 0.05, with different variance estimates from the test fishery, and varying levels of detectable differences, d , for sockeye proportions between the test fishery on closures and the commercial fishery on adjacent days.

Test Fishery Variance Estimates	Variance of Sockeye Proportions	Sample Sizes		
		$d = 0.05$	$d = 0.10$	$d = 0.15$
Test Fishery, First Closure	0.00816	11	4	3
Test Fishery, Second Closure	0.00349	6	3	3
Test Fishery, Third Closure	0.01252	16	6	4

Table 14.-Sample size estimates for an α -level of 0.05, with varying sockeye proportion variance estimates from the test fishery and commercial fishery, and varying levels of detectable differences, d , for sockeye proportions between samples and the June fishery.

Source for Variance Estimates	Variance of Sockeye Proportions	Sample Sizes		
		$d = 0.05$	$d = 0.10$	$d = 0.15$
Test Fishery, Overall	0.00716	10	4	3
Test Fishery Vessels	0.01918	23	8	5
Seine Commercial Fishery	0.03197	37	11	6
Seine and Drift Gillnet Commercial Fish	0.02087	25	8	5

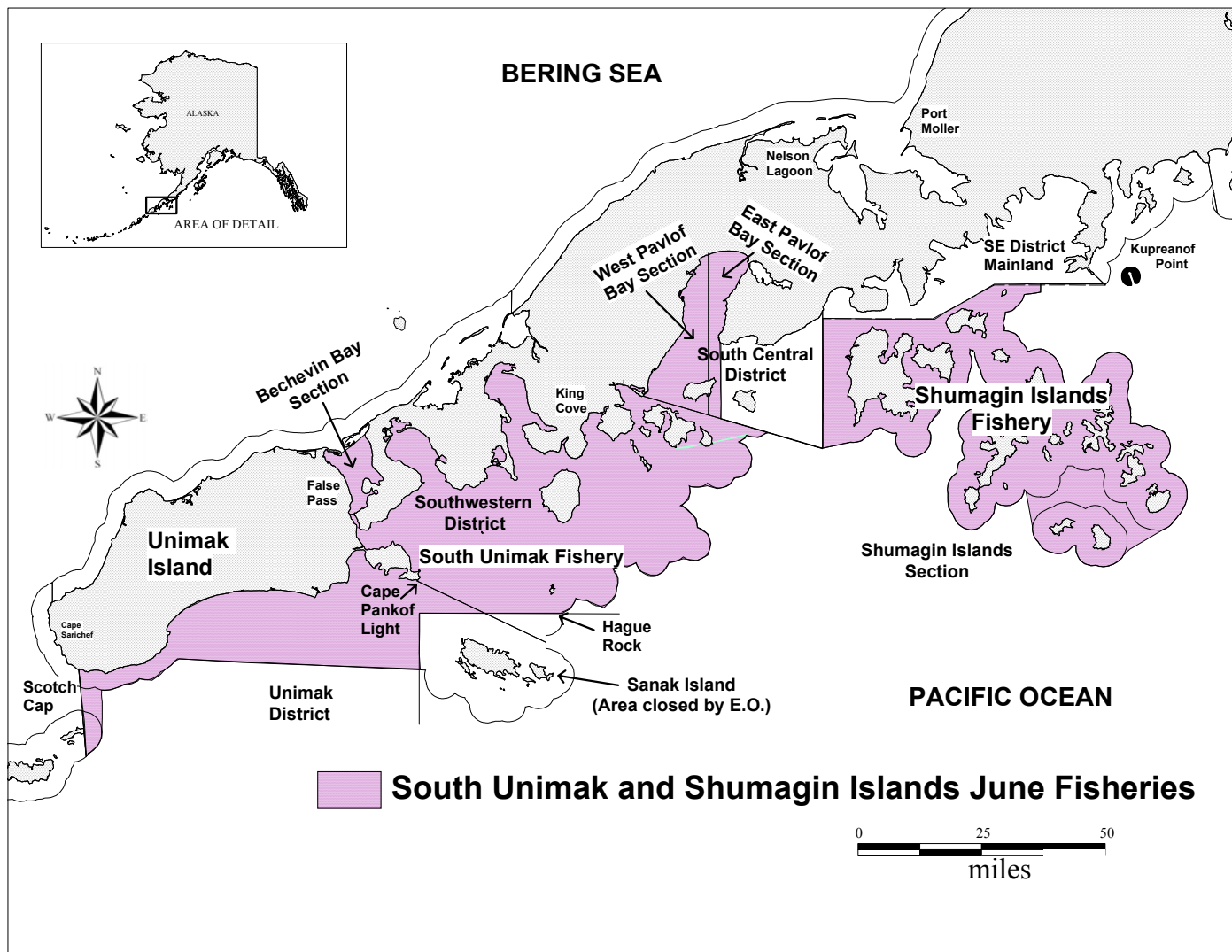


Figure 1.-Map of the South Unimak and Shumigan Islands June fisheries areas.

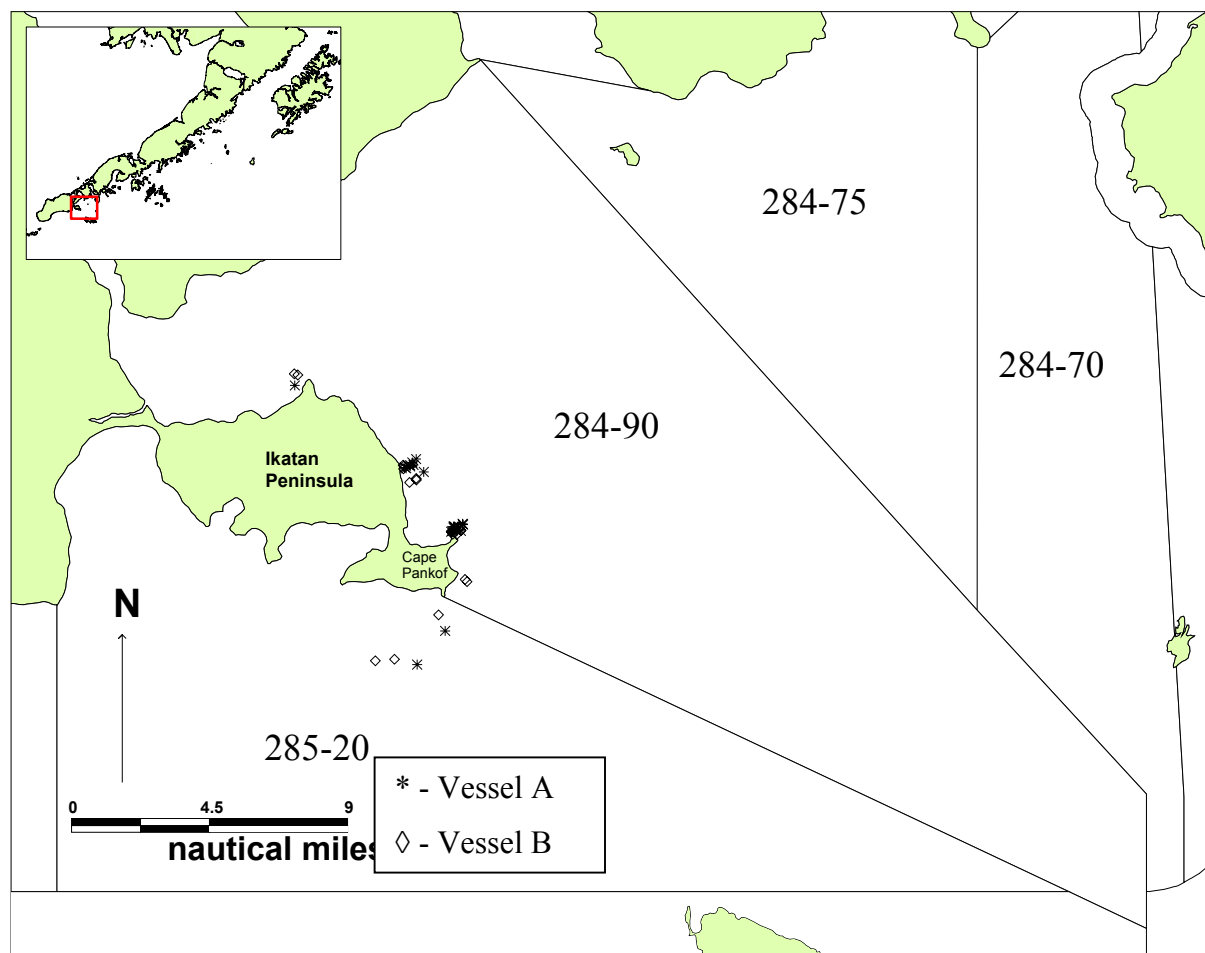


Figure 2.-Map of set locations during the test fisheries, June 2004.

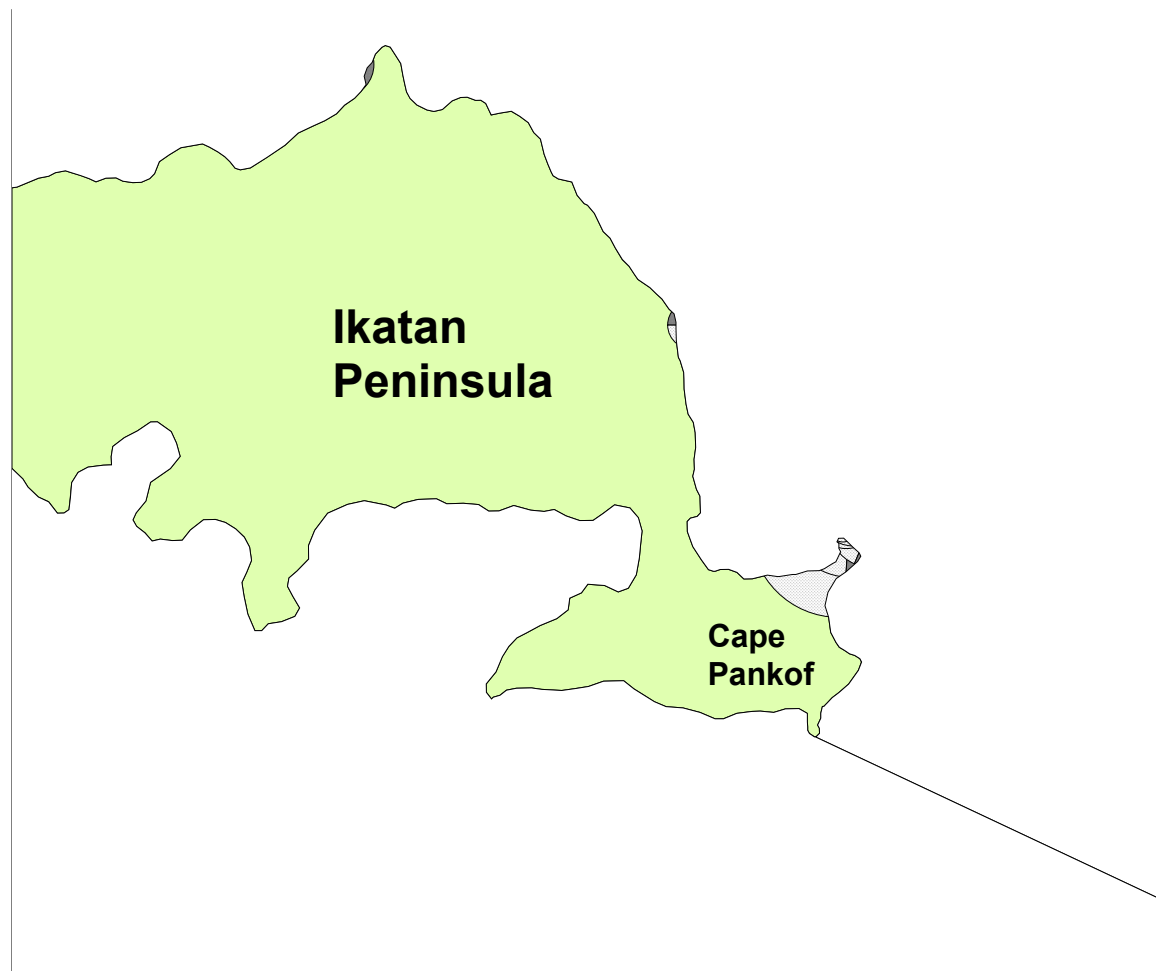


Figure 3.-Catch by location for Vessel A during the test fisheries June 2004.

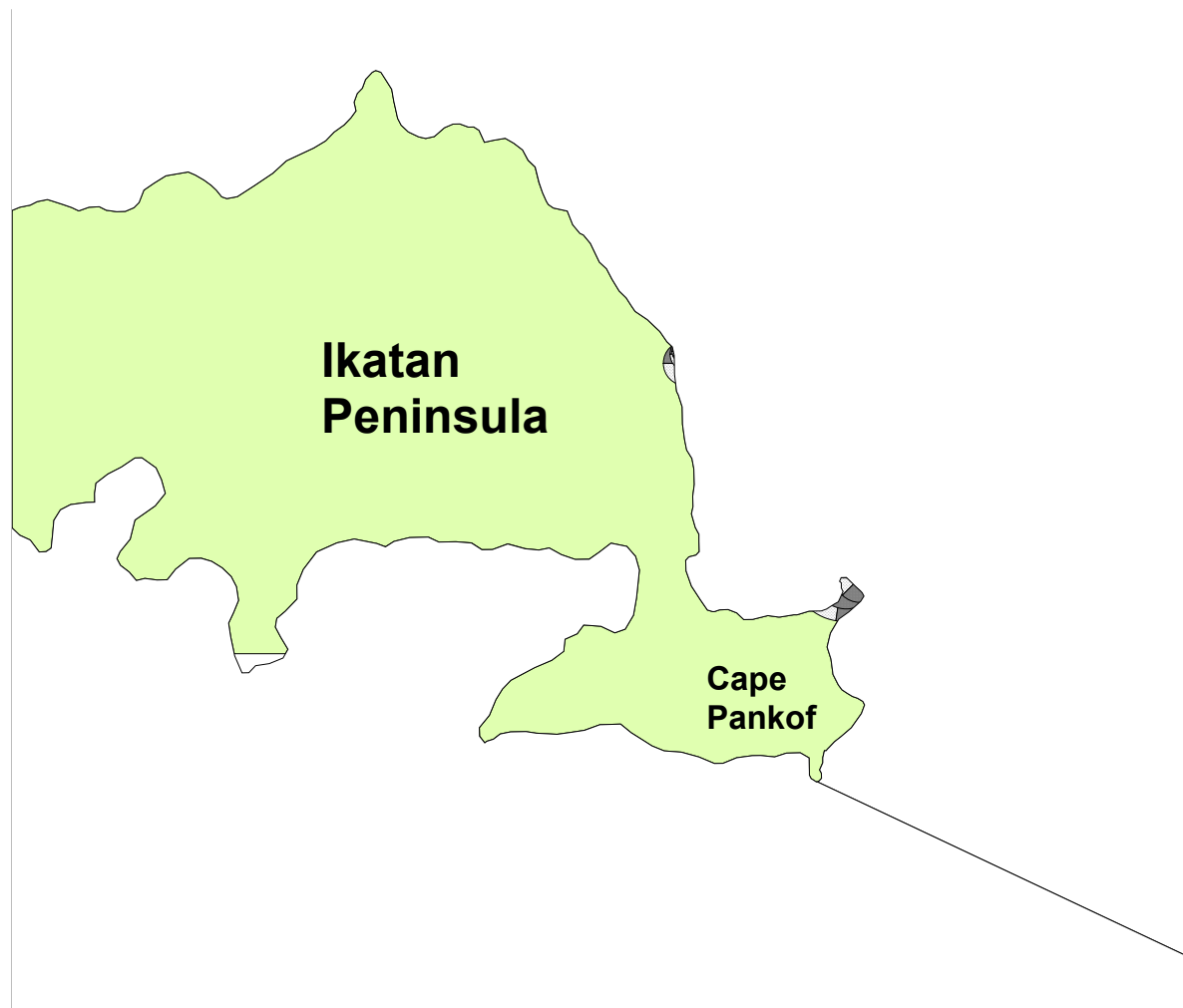


Figure 4.-Catch by location for Vessel B during the test fisheries June 2004.

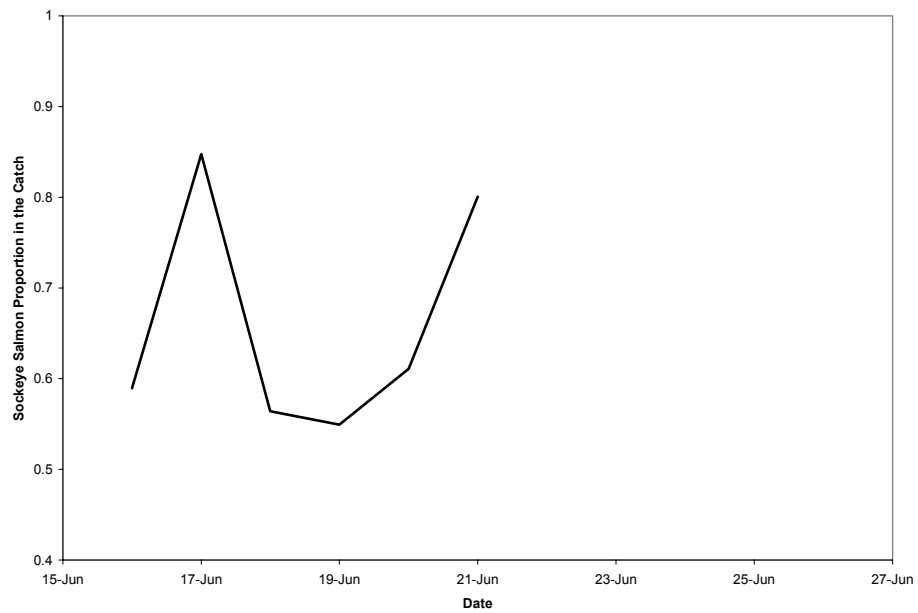


Figure 5.-Sockeye proportions from Vessel A catches by day from June 16 to June 21, 2004.

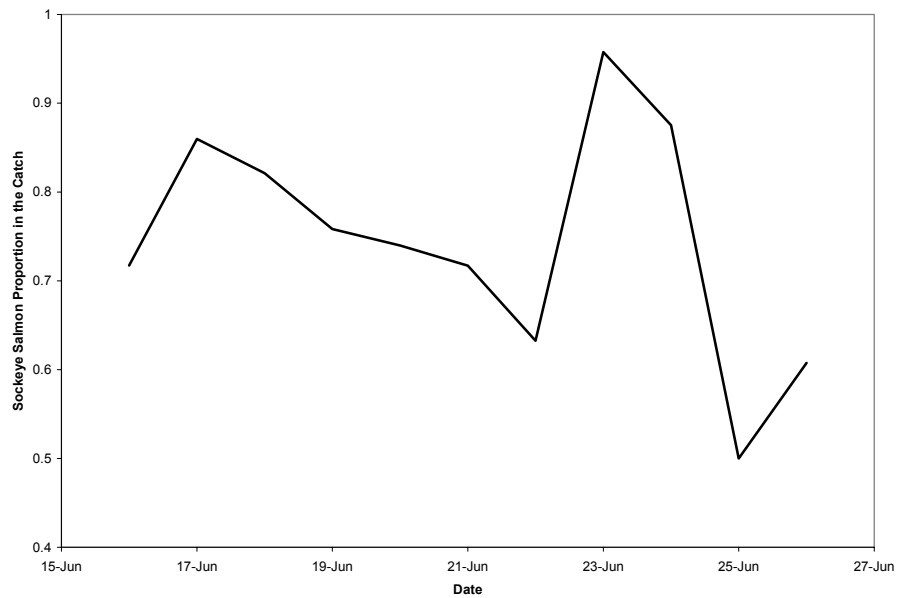


Figure 6.-Sockeye proportions from Vessel B catches by day from June 16 to June 26, 2004.

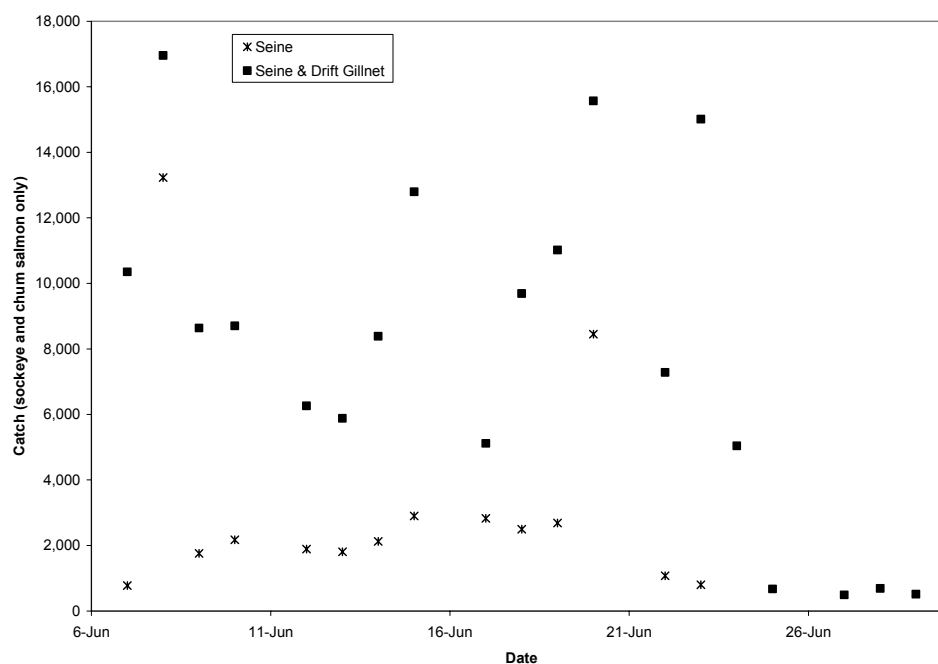


Figure 7.-Commercial catch of sockeye and chum salmon only from ADF&G Statistical Area 284-90, by day from June 2004.

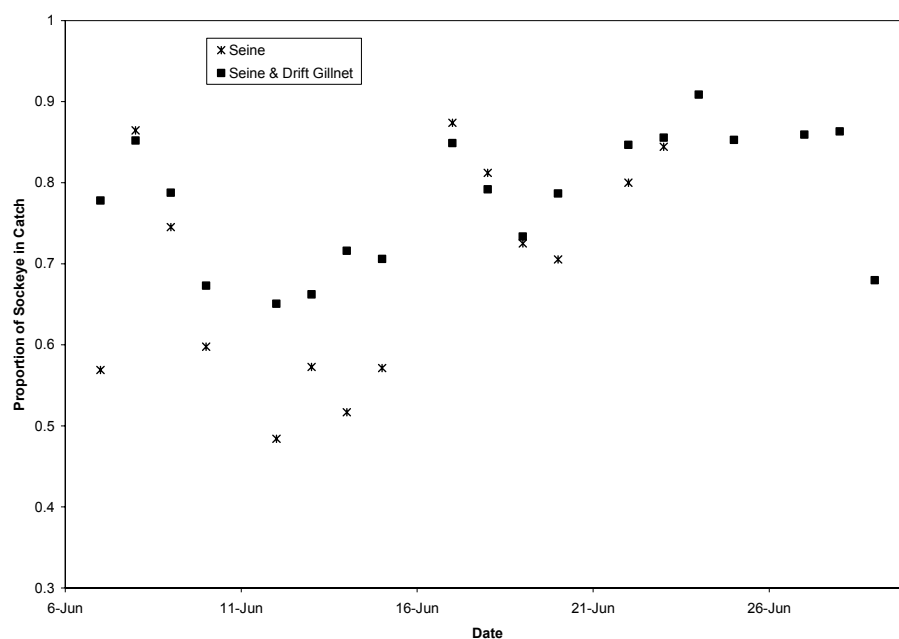


Figure 8.-Sockeye proportion in the commercial catch from ADF&G Statistical Area 284-90, by day from June 2004.

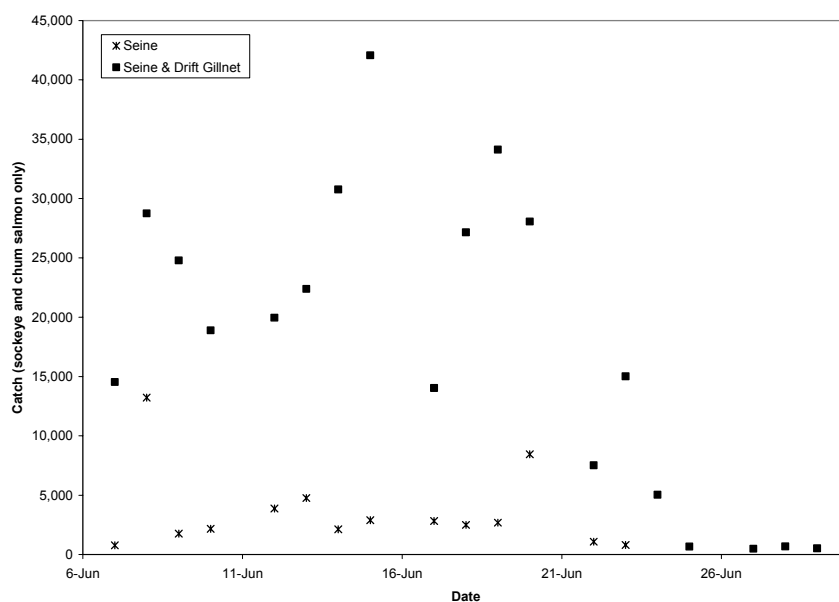


Figure 9.-Commercial catch of sockeye and chum salmon only from ADF&G Statistical Areas 284-90 and 285-20 combined, by day from June 2004.

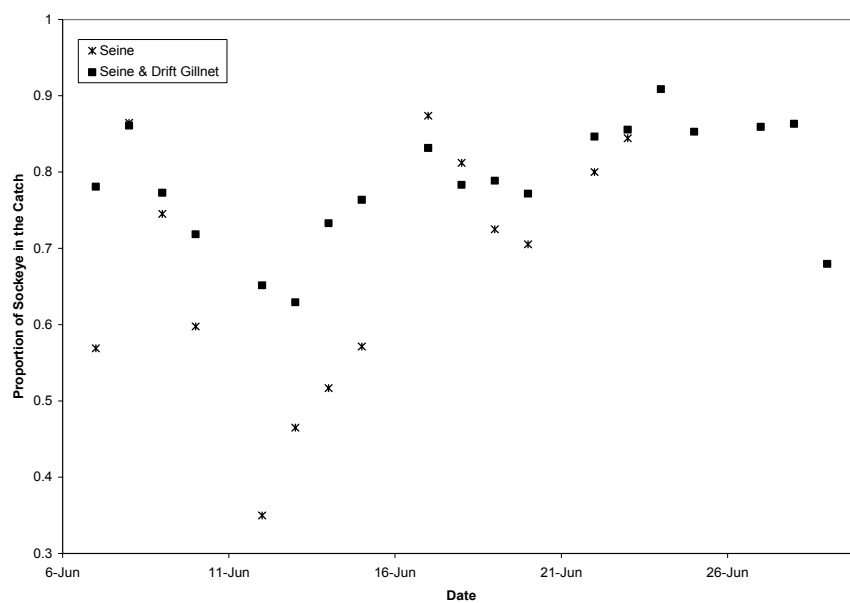


Figure 10.-Sockeye proportion in the commercial catch from ADF&G Statistical Areas 284-90 and 285-20 combined, by day from June 2004.

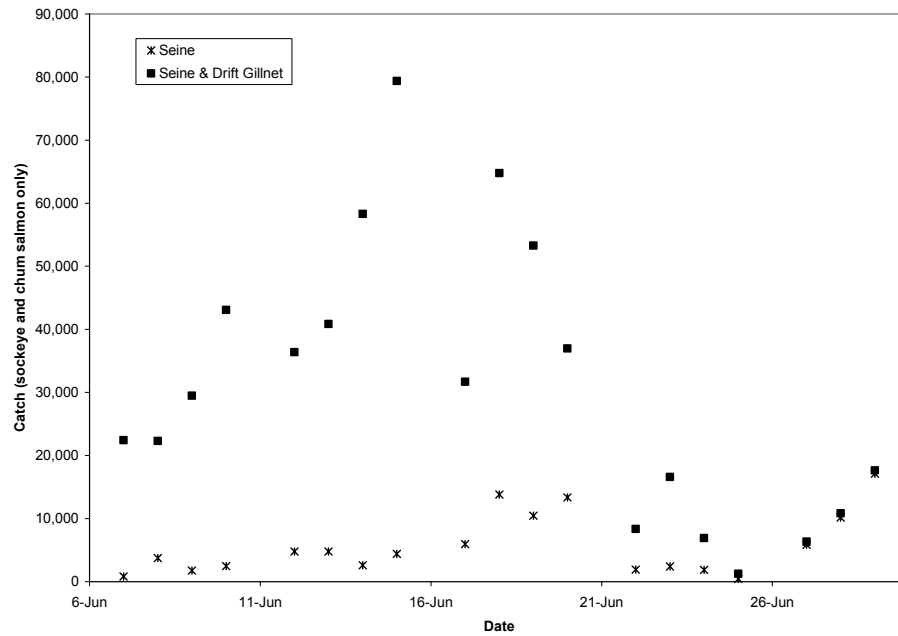


Figure 11.-Commercial catch of sockeye and chum salmon only from the South Unimak Area, by day from June 2004.

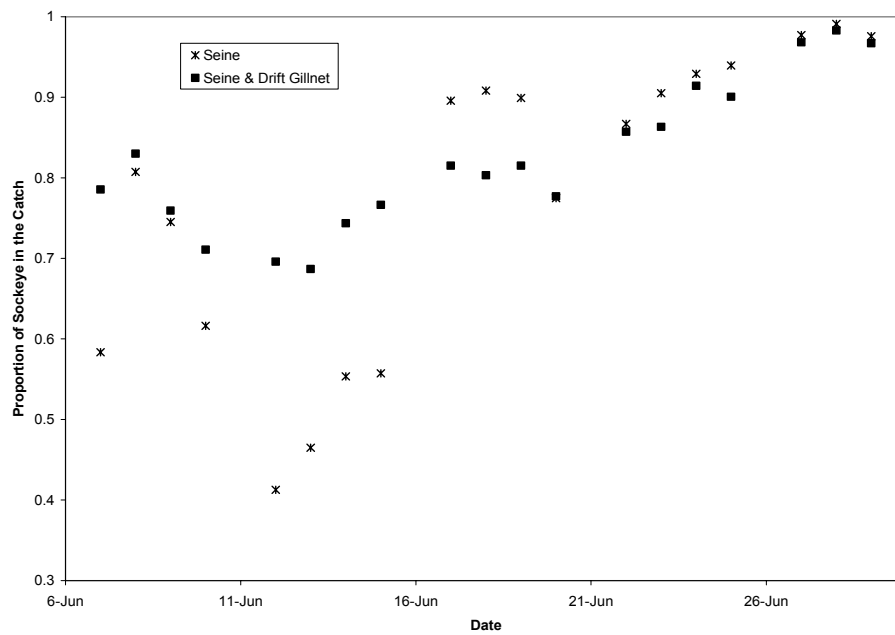


Figure 12.-Sockeye proportion in the commercial catch from the South Unimak Area, by day from June 2004.

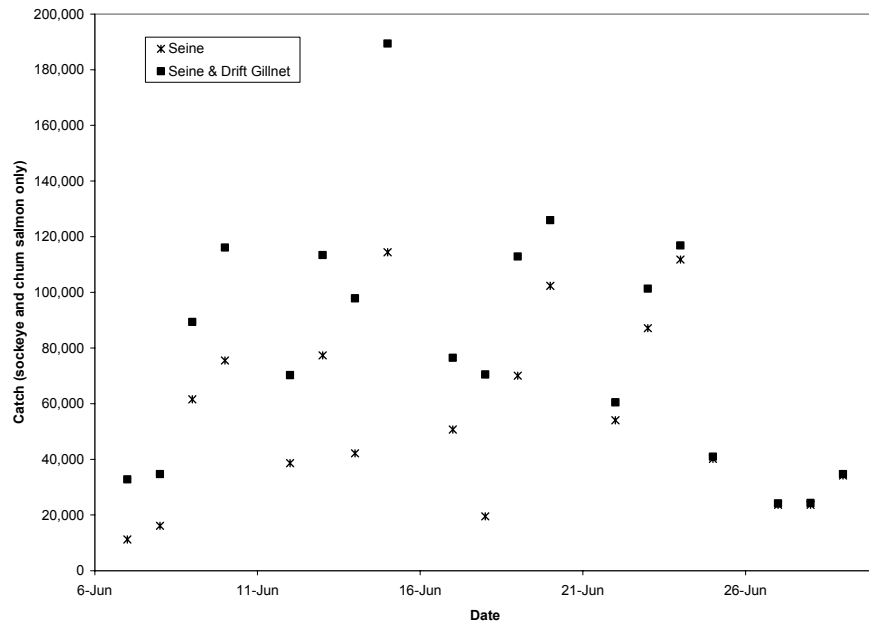


Figure 13.-Commercial catch of sockeye and chum salmon only from the South Unimak and Shumagin Islands Areas, by day from June 2004.

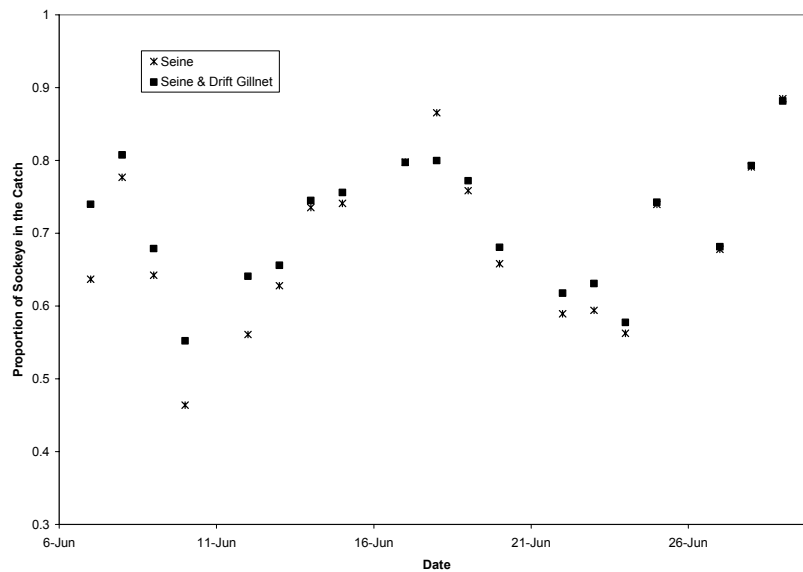


Figure 14.-Sockeye proportion in the commercial catch from the South Unimak and Shumagin Islands Areas, by day from June 2004.

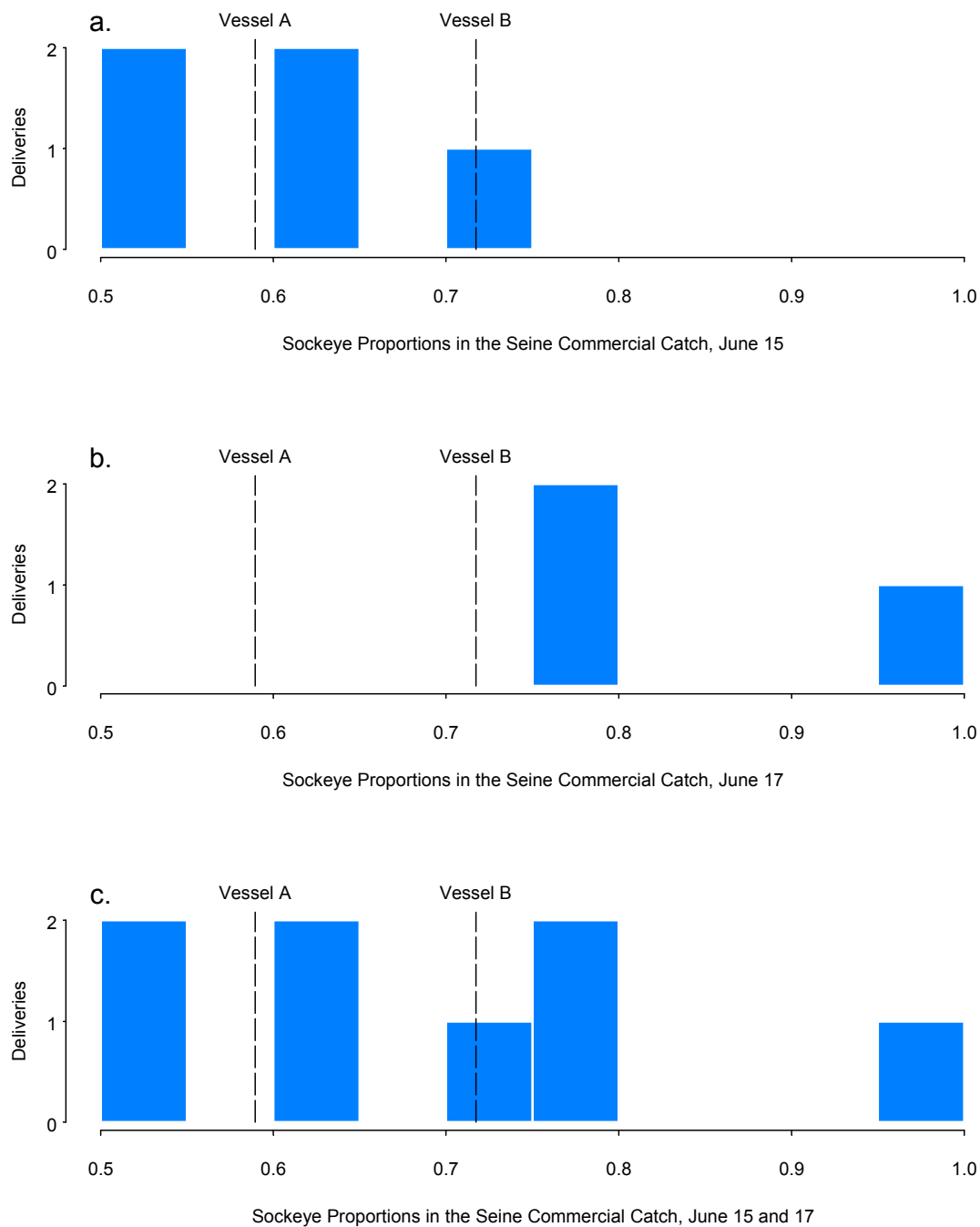


Figure 15.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

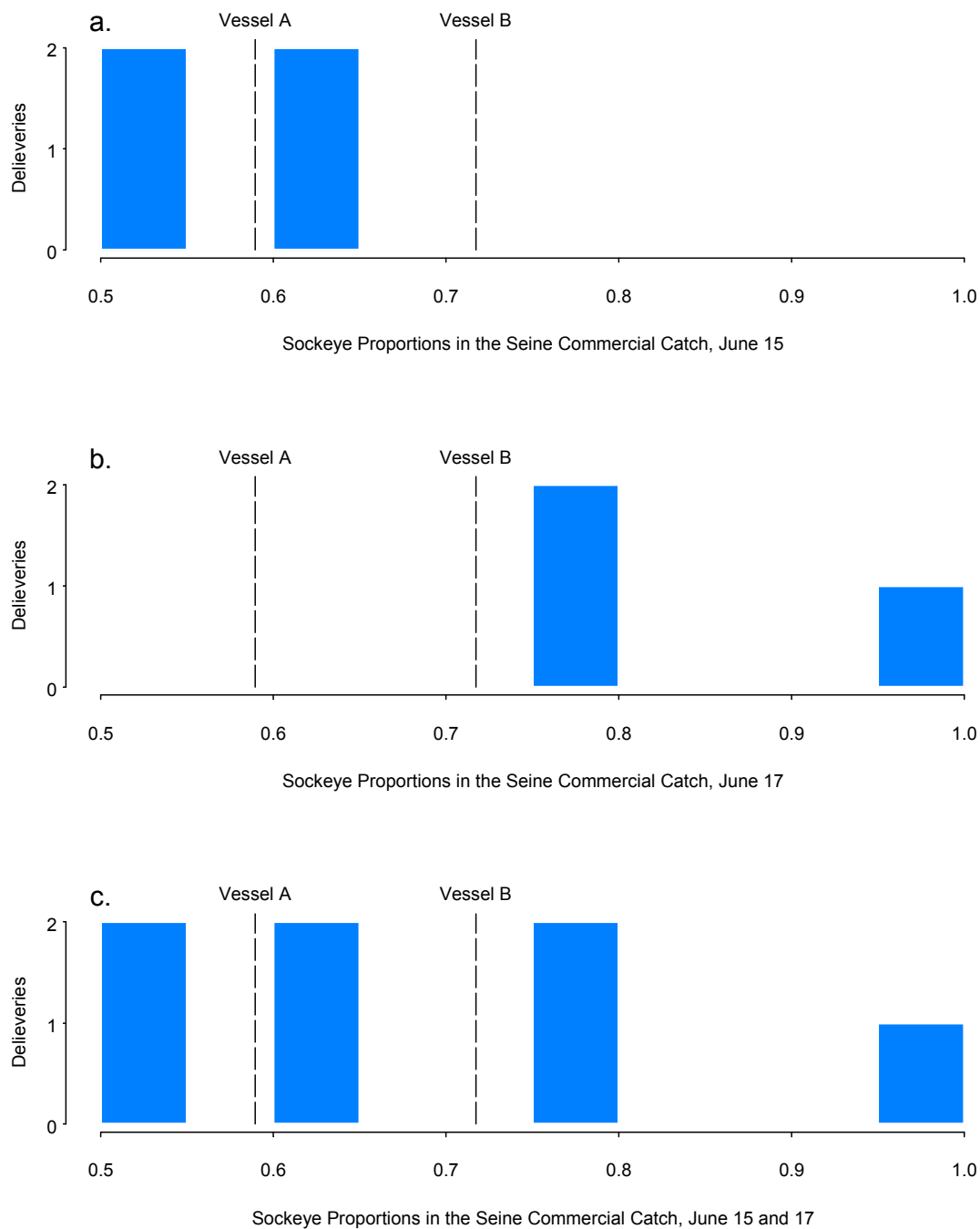


Figure 16.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

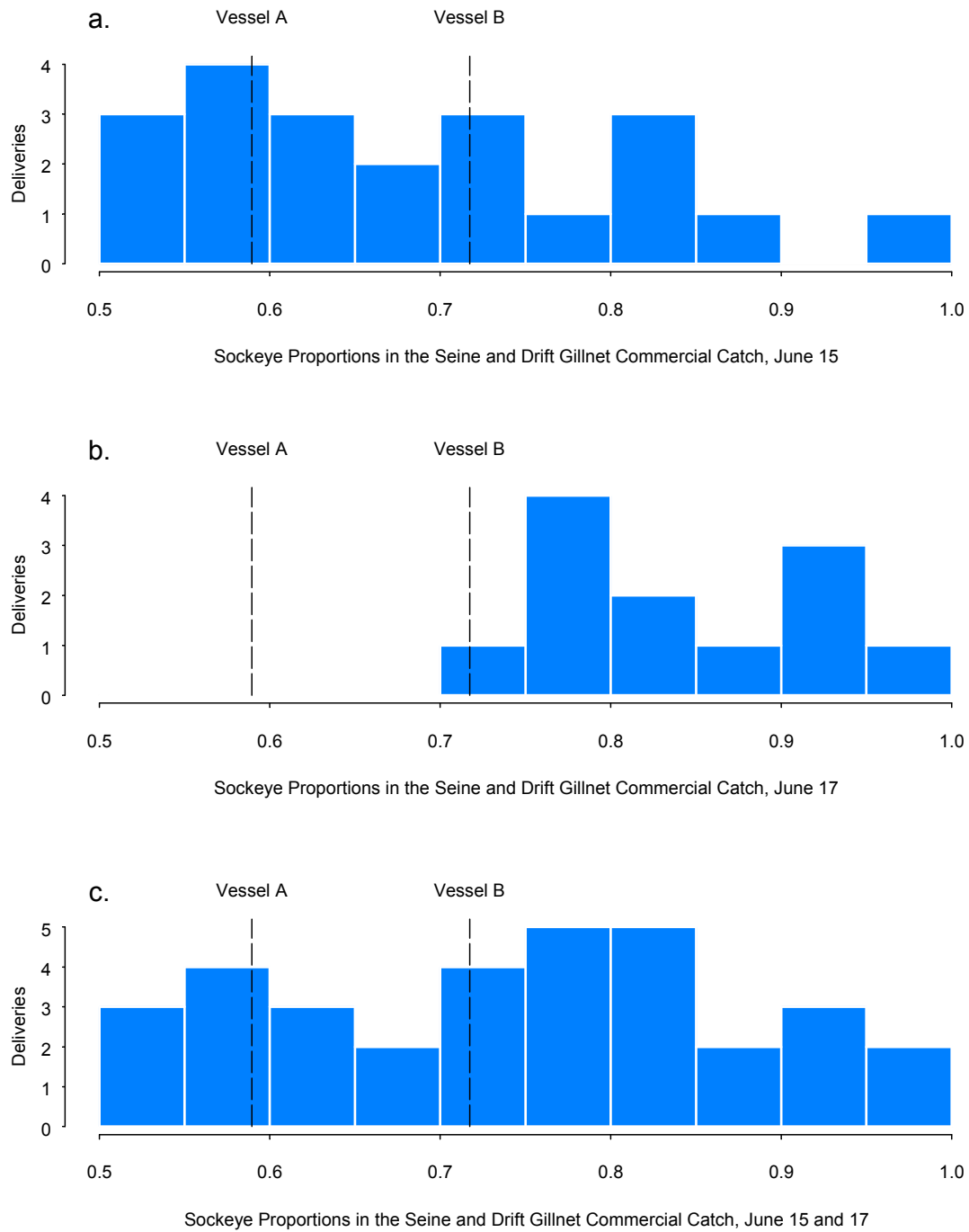


Figure 17.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

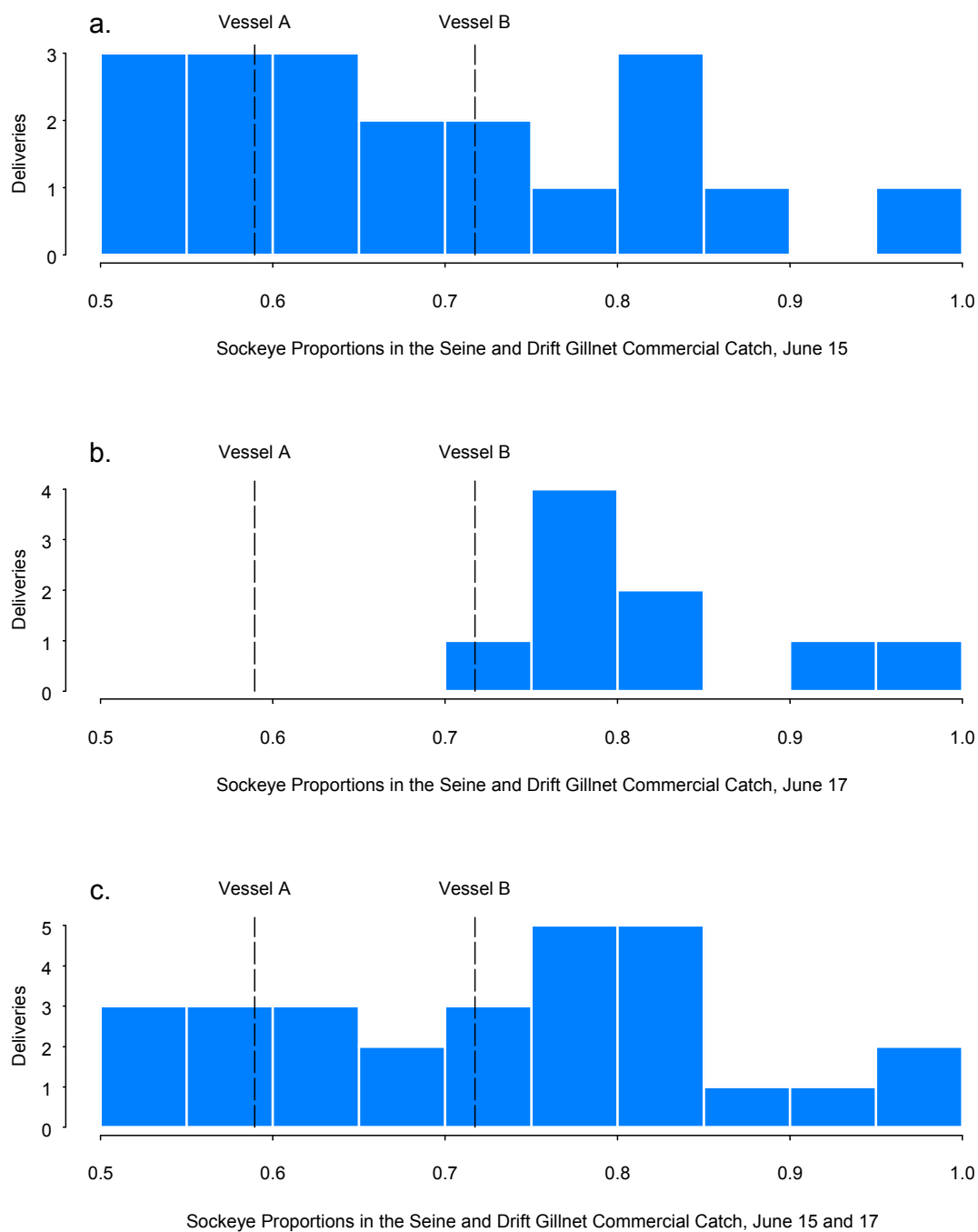


Figure 18.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Area 284-90, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

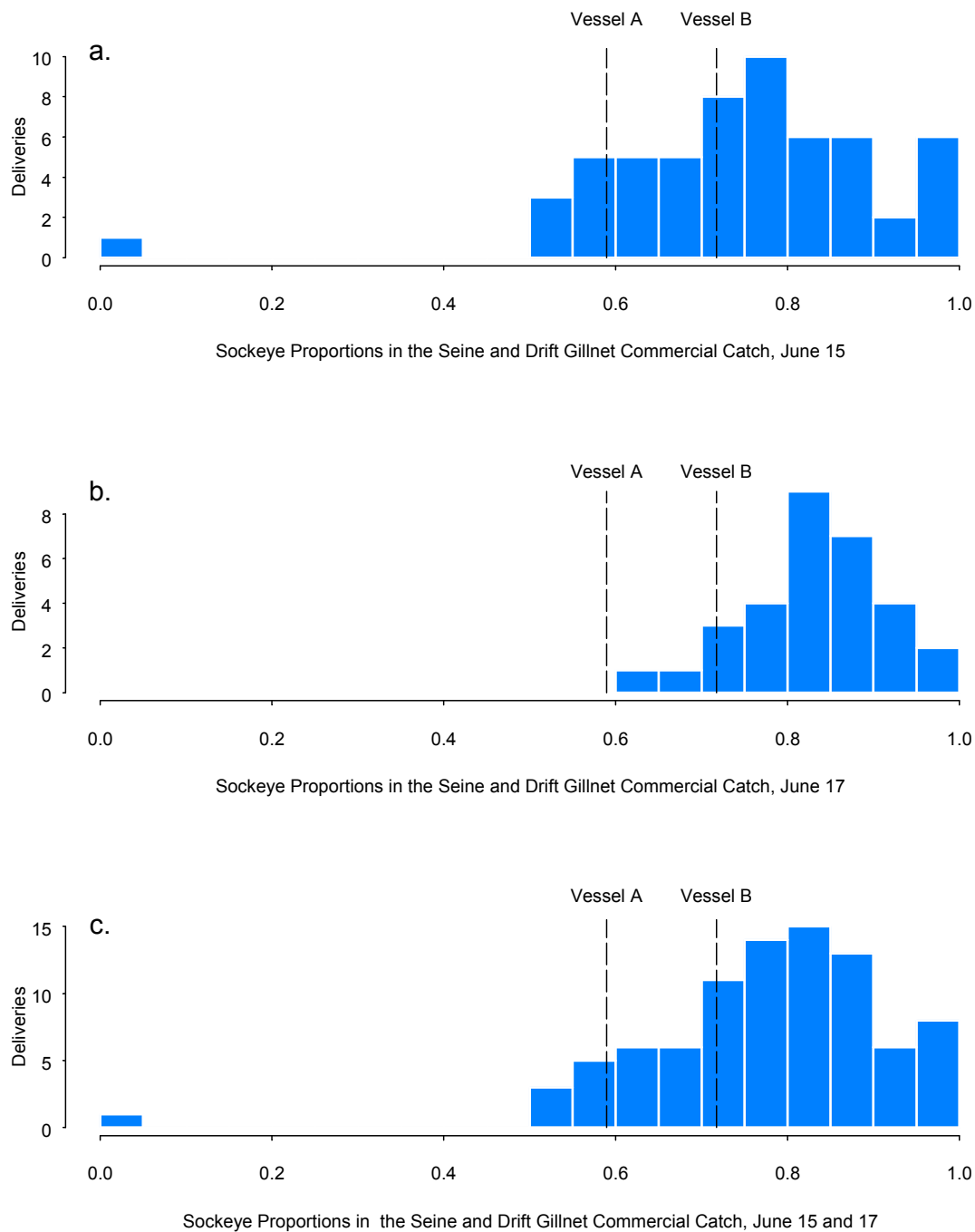


Figure 19.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

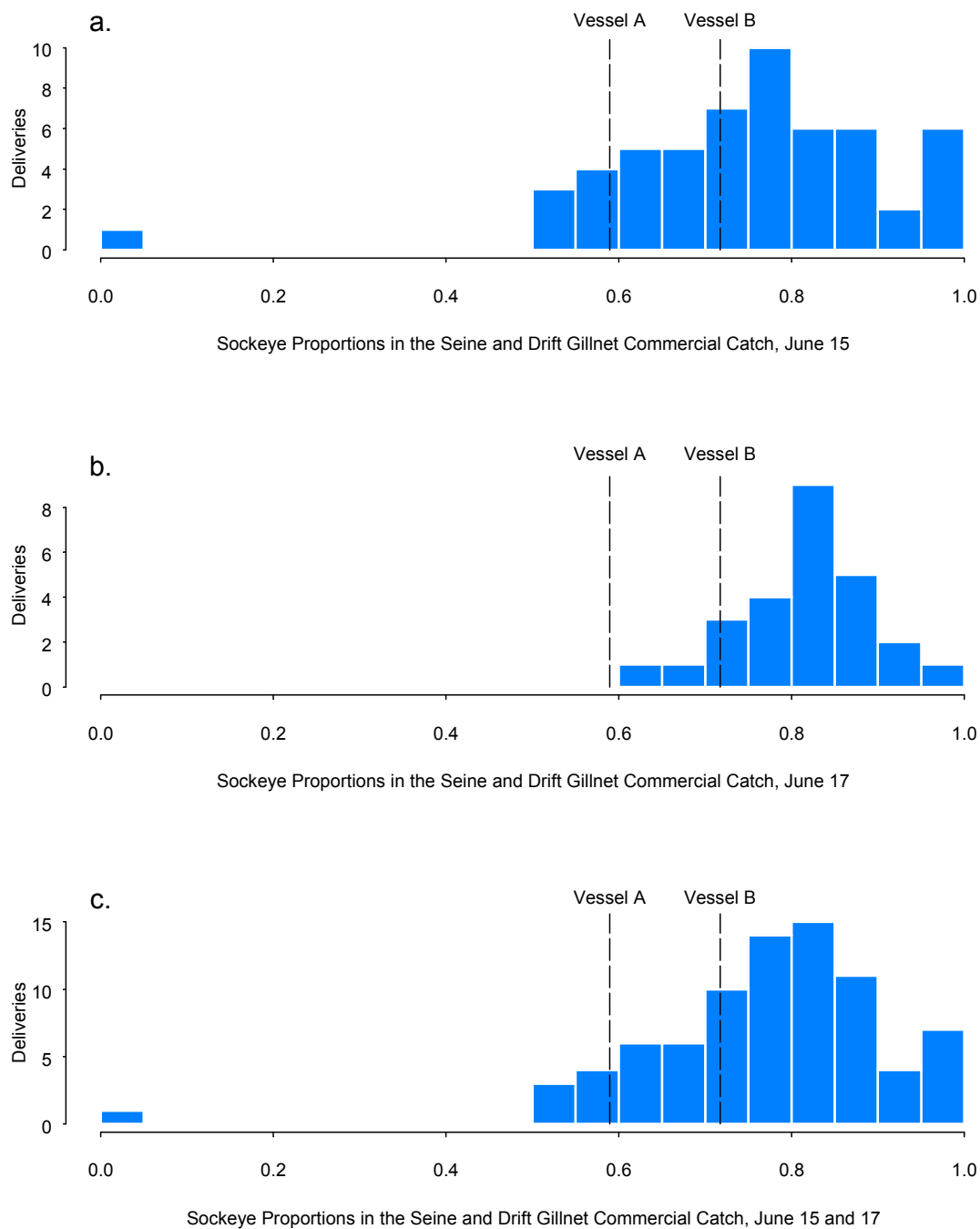


Figure 20.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

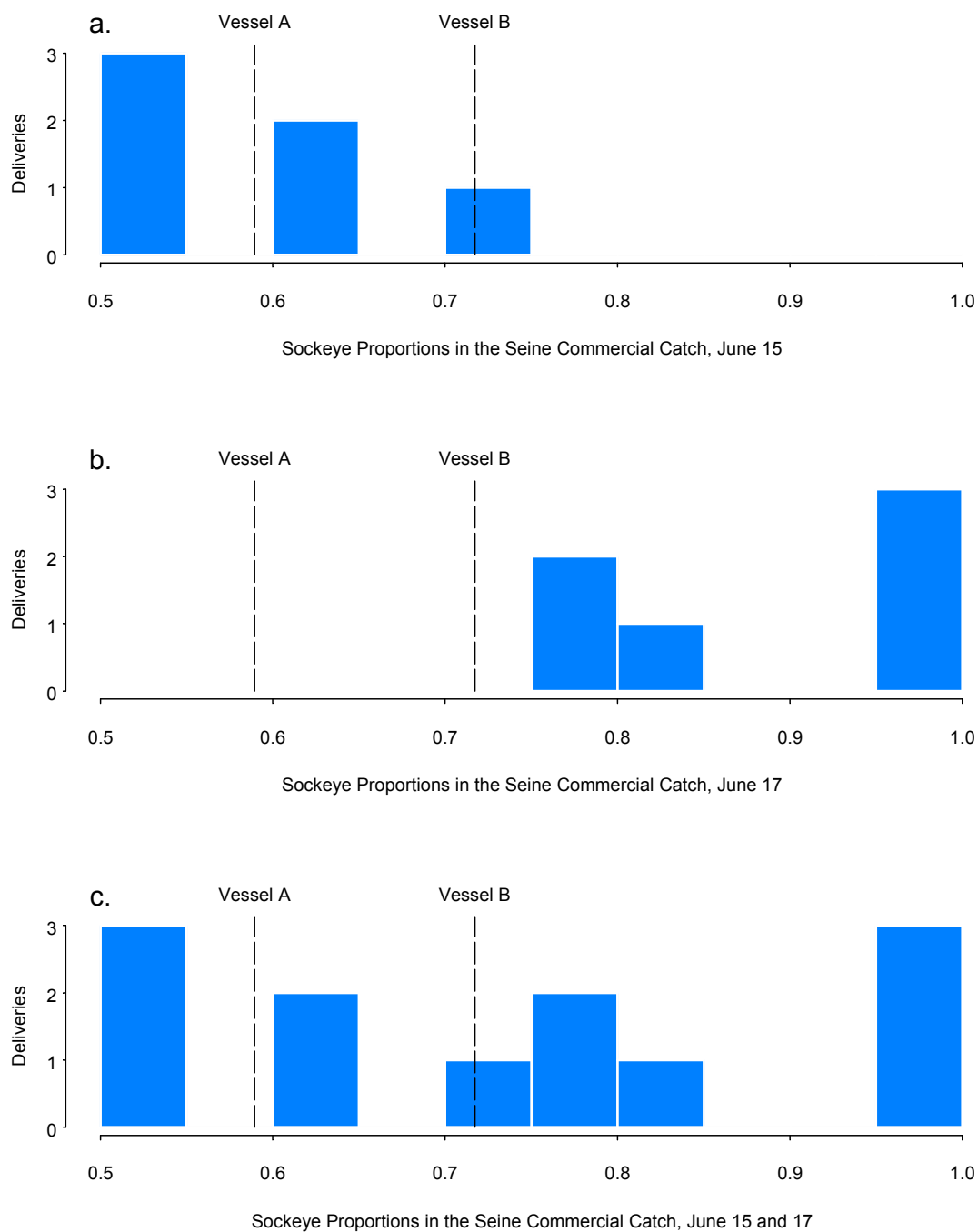


Figure 21.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

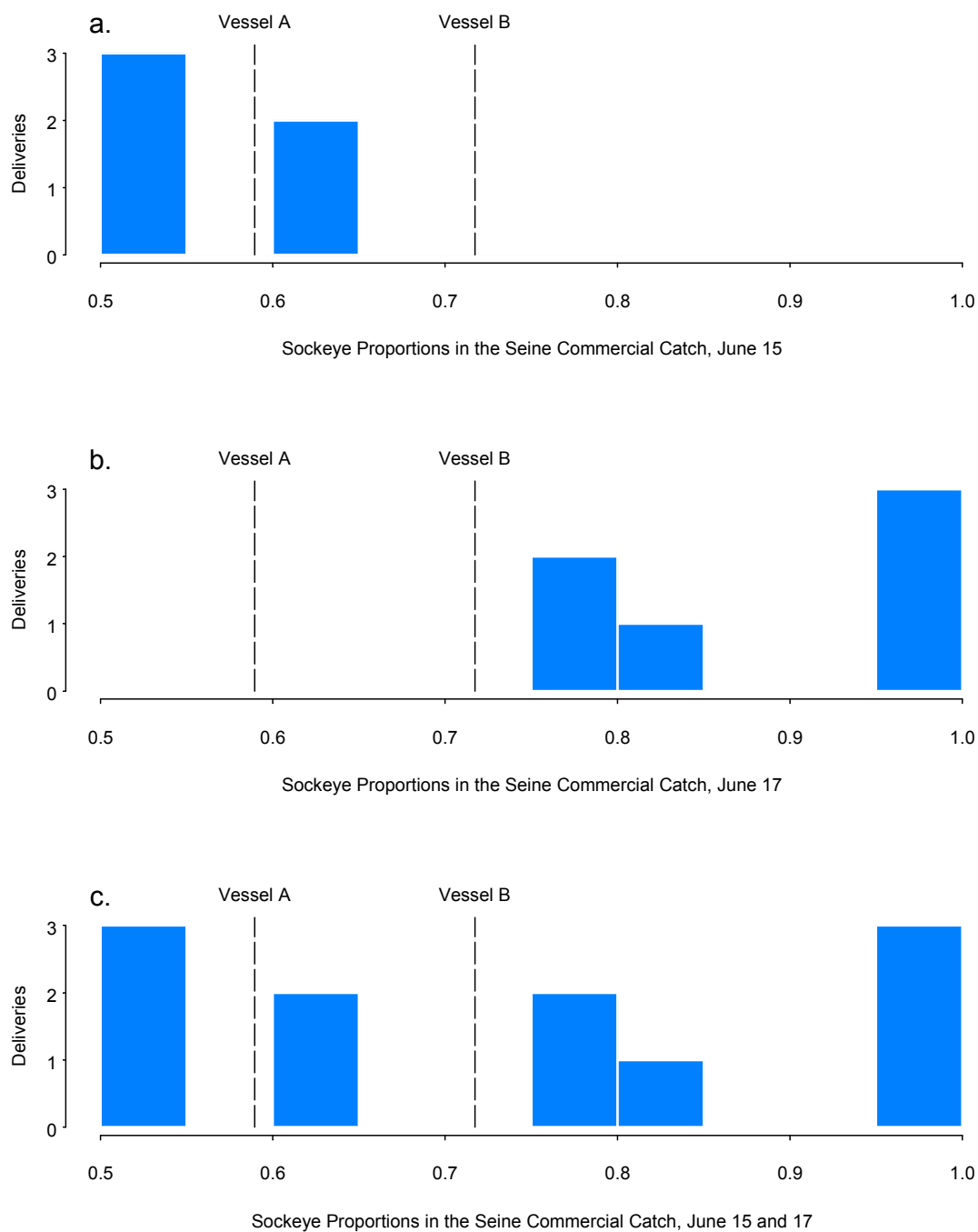


Figure 22.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

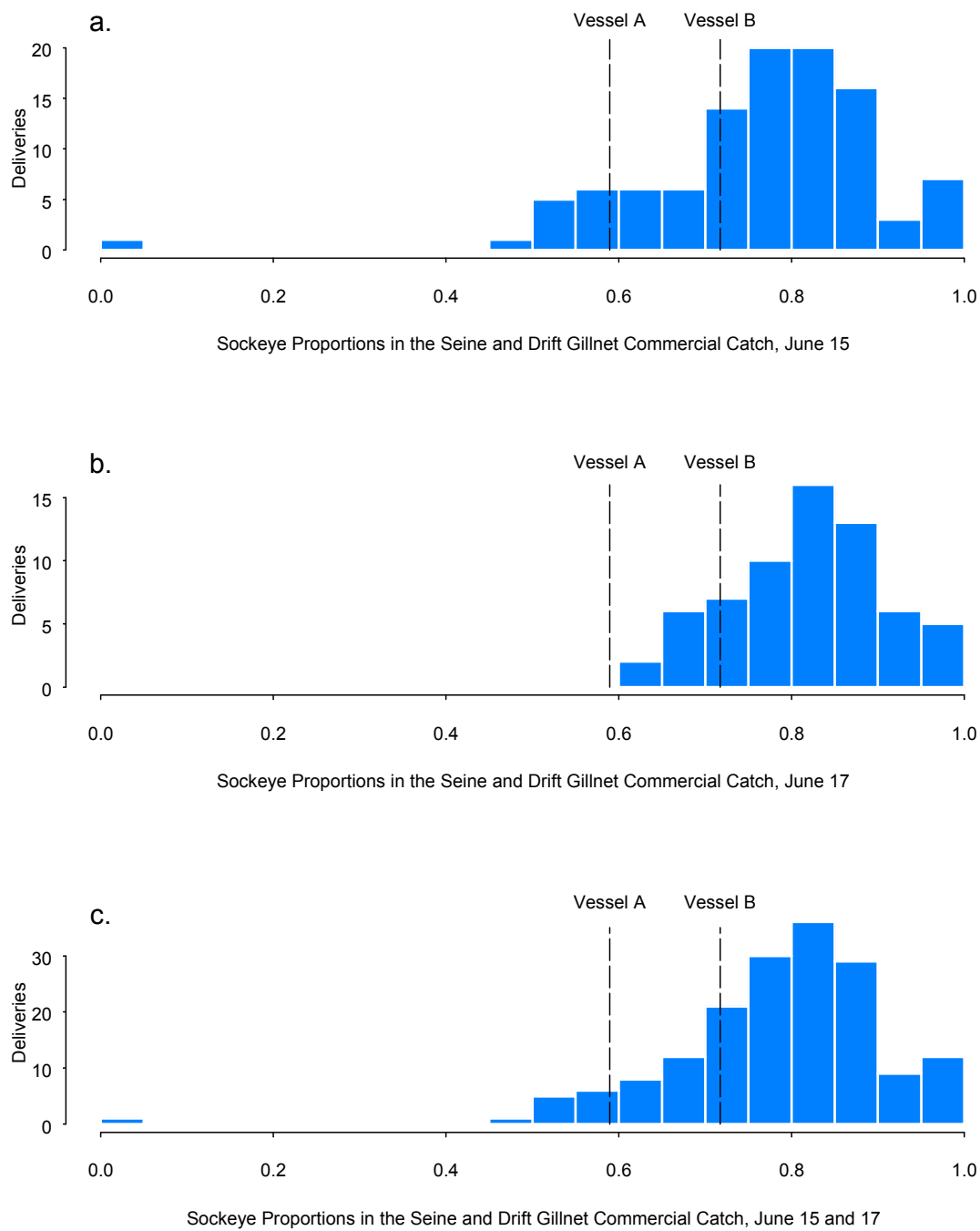


Figure 23.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

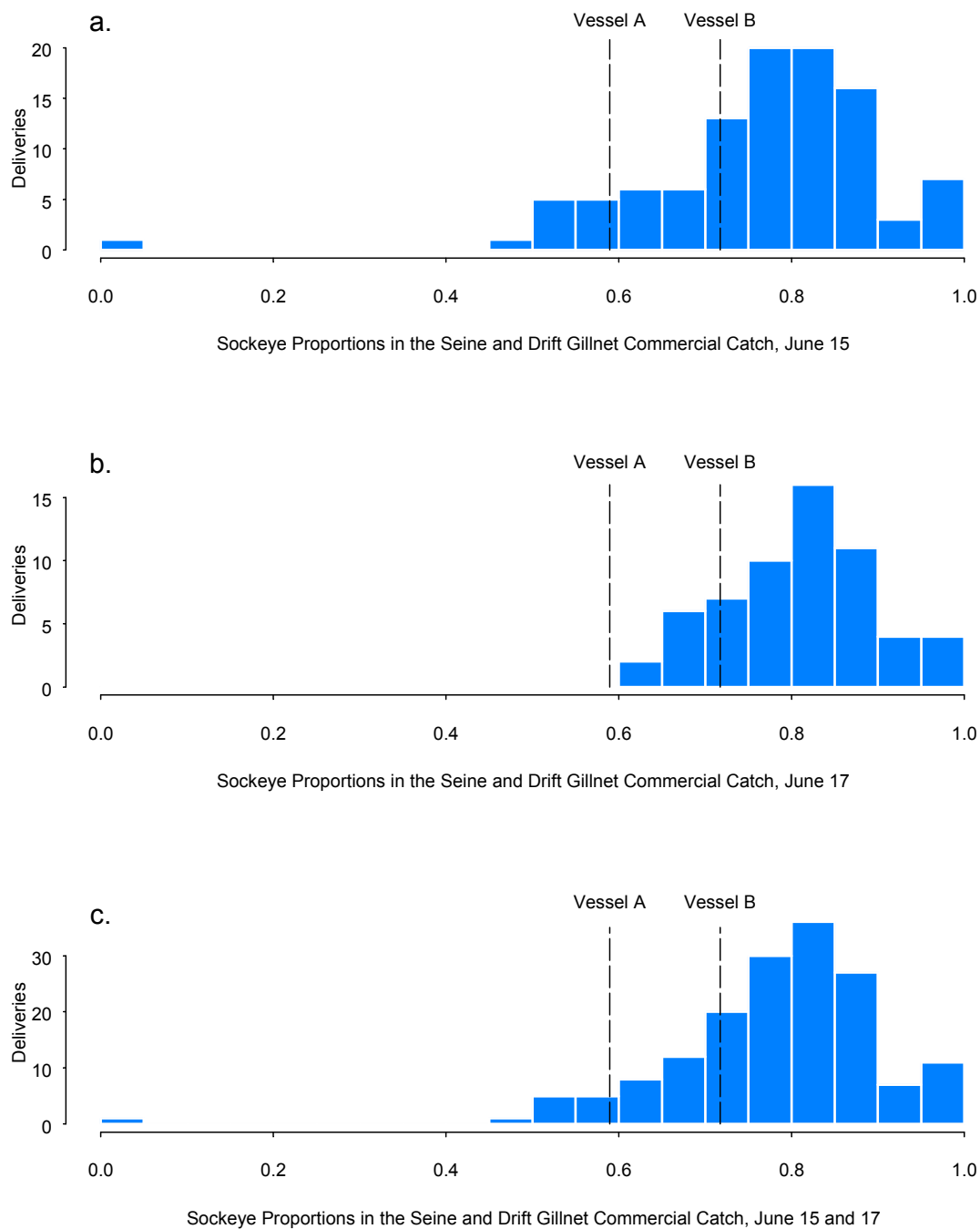


Figure 24.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

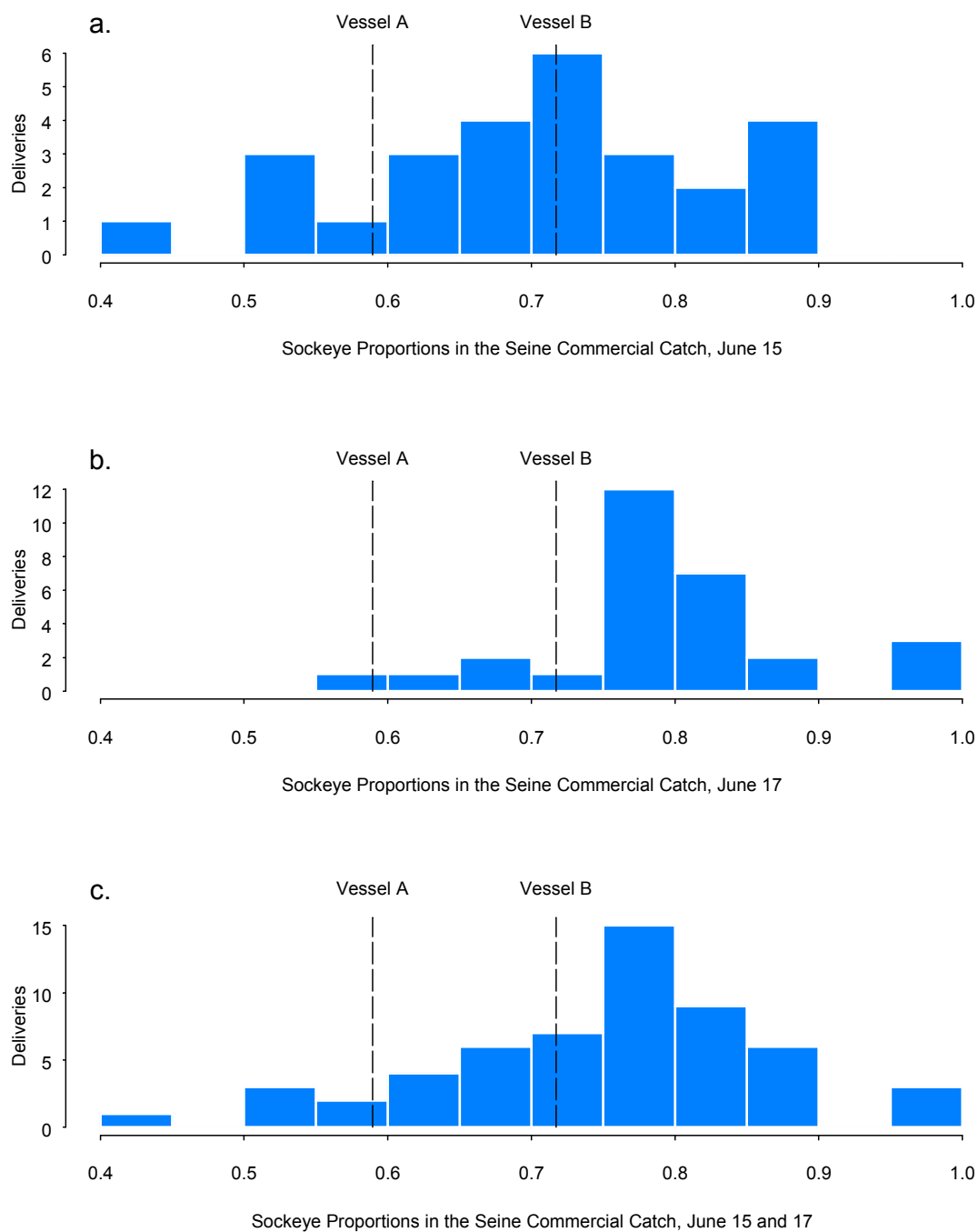


Figure 25.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

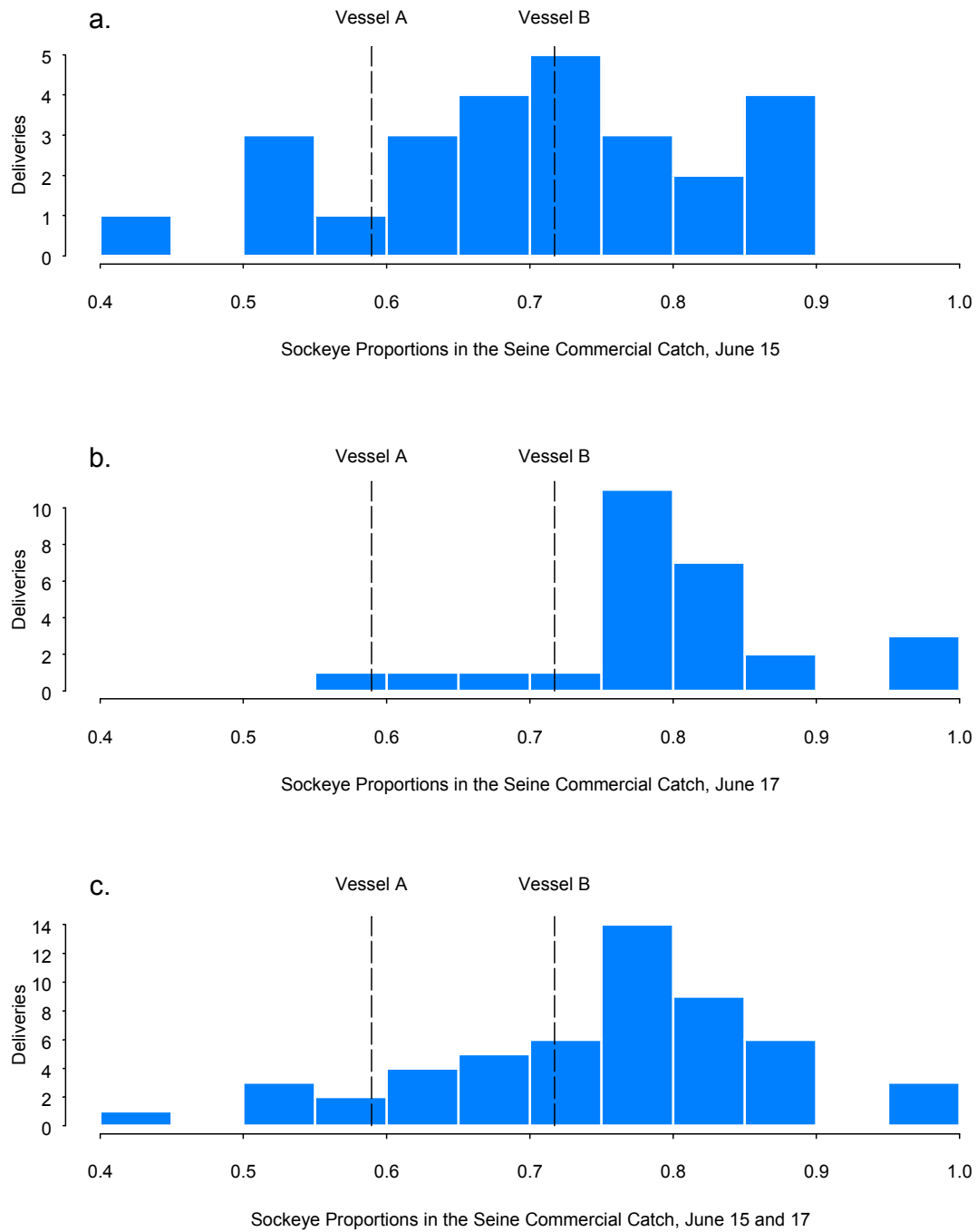


Figure 26.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

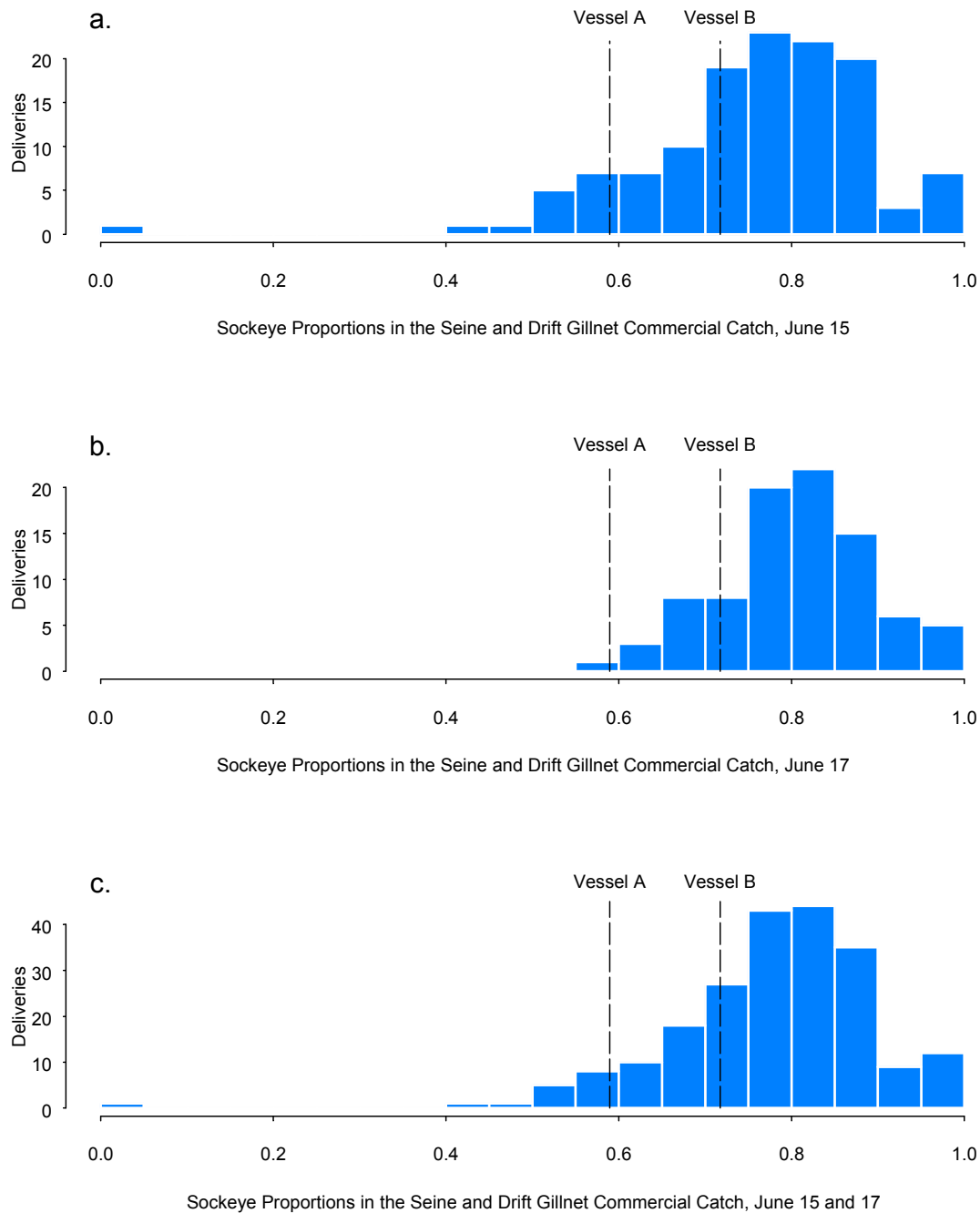


Figure 27.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

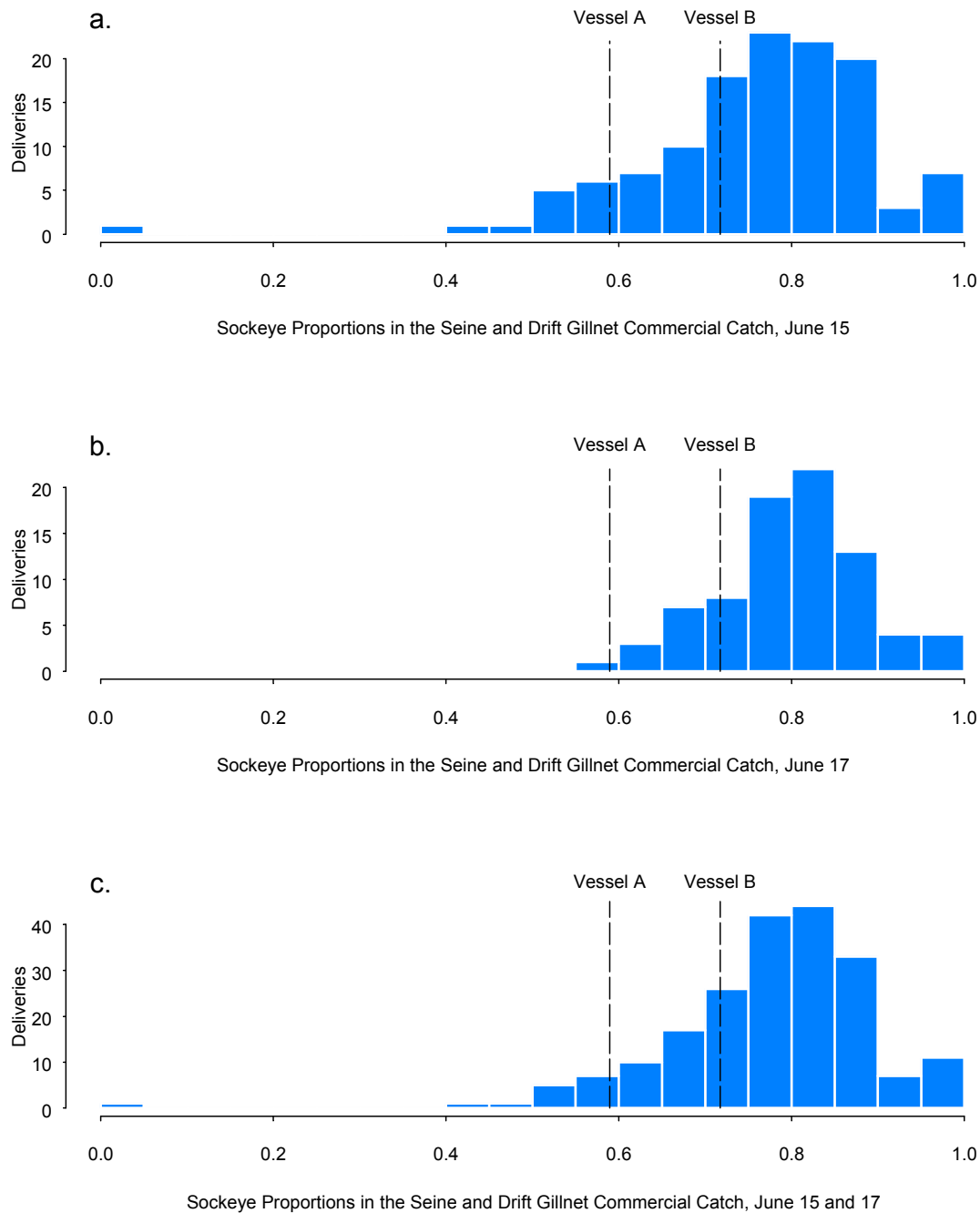


Figure 28.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 15, (b) June 17, and (c) June 15 and 17 combined, with sockeye proportions from the individual test fishery vessels on June 16, 2004.

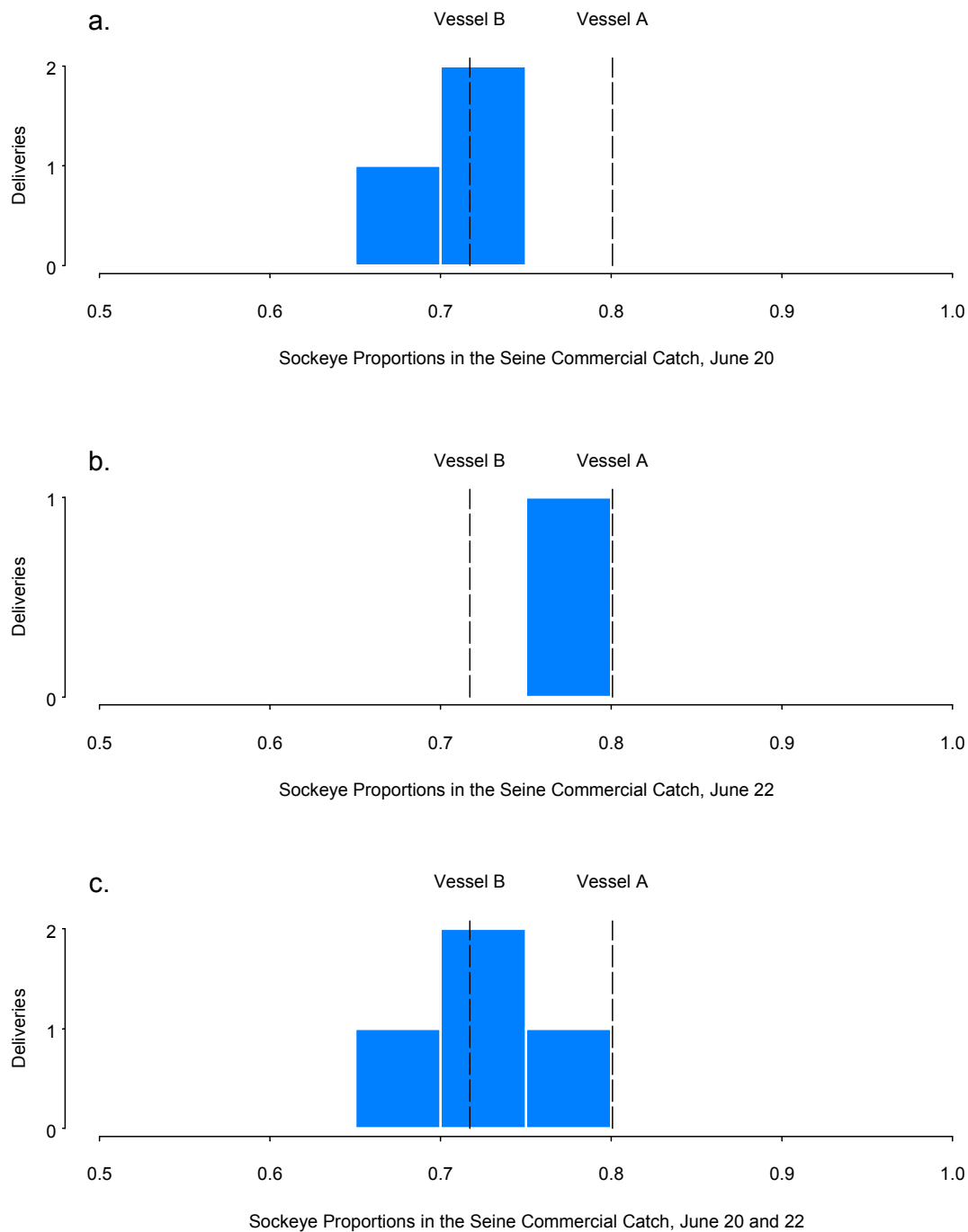


Figure 29.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of ADF&G Statistical Area 284-90, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

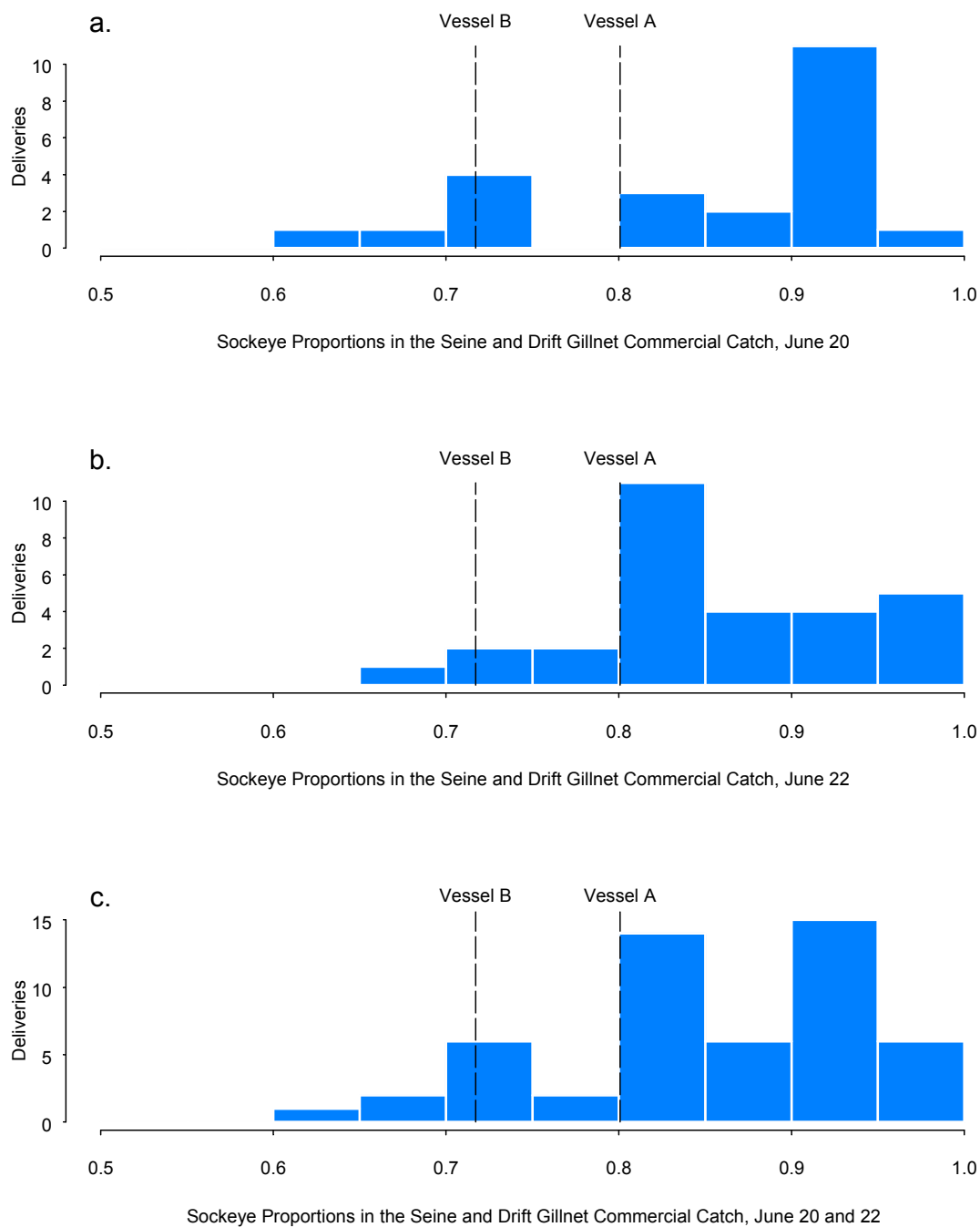


Figure 30.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Area 284-90, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

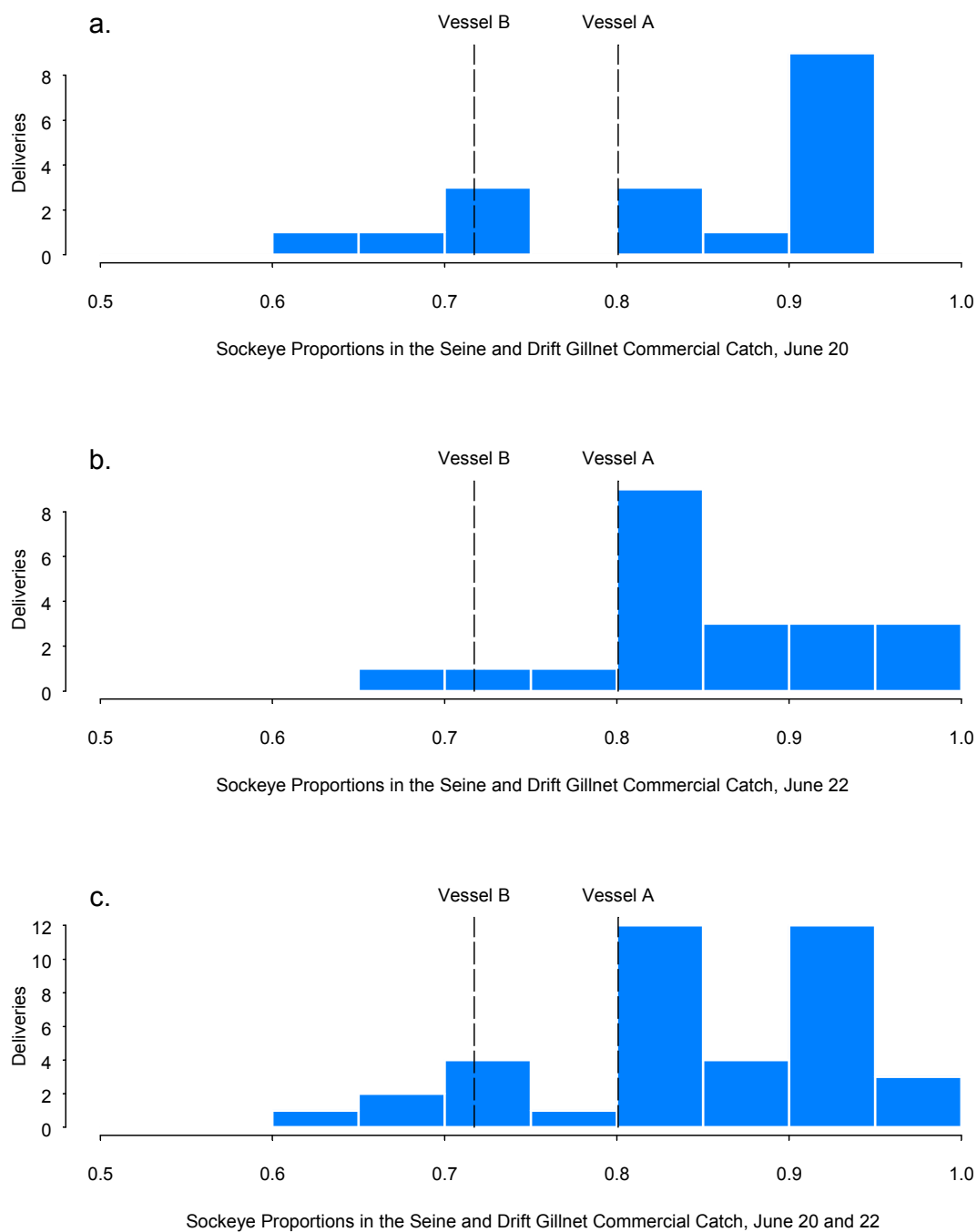


Figure 31.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch from vessels that caught 150 or more fish for ADF&G Statistical Area 284-90, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

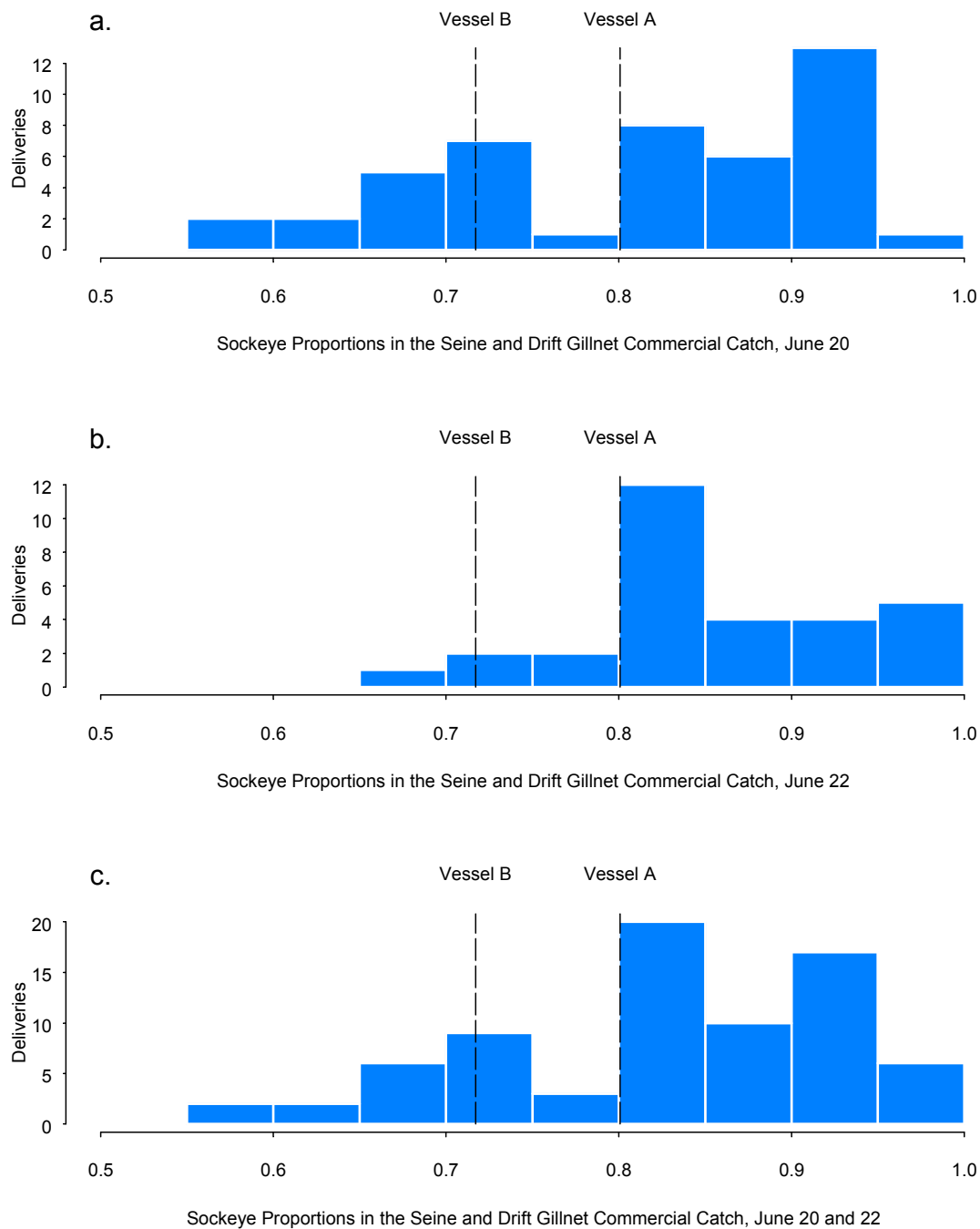


Figure 32.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

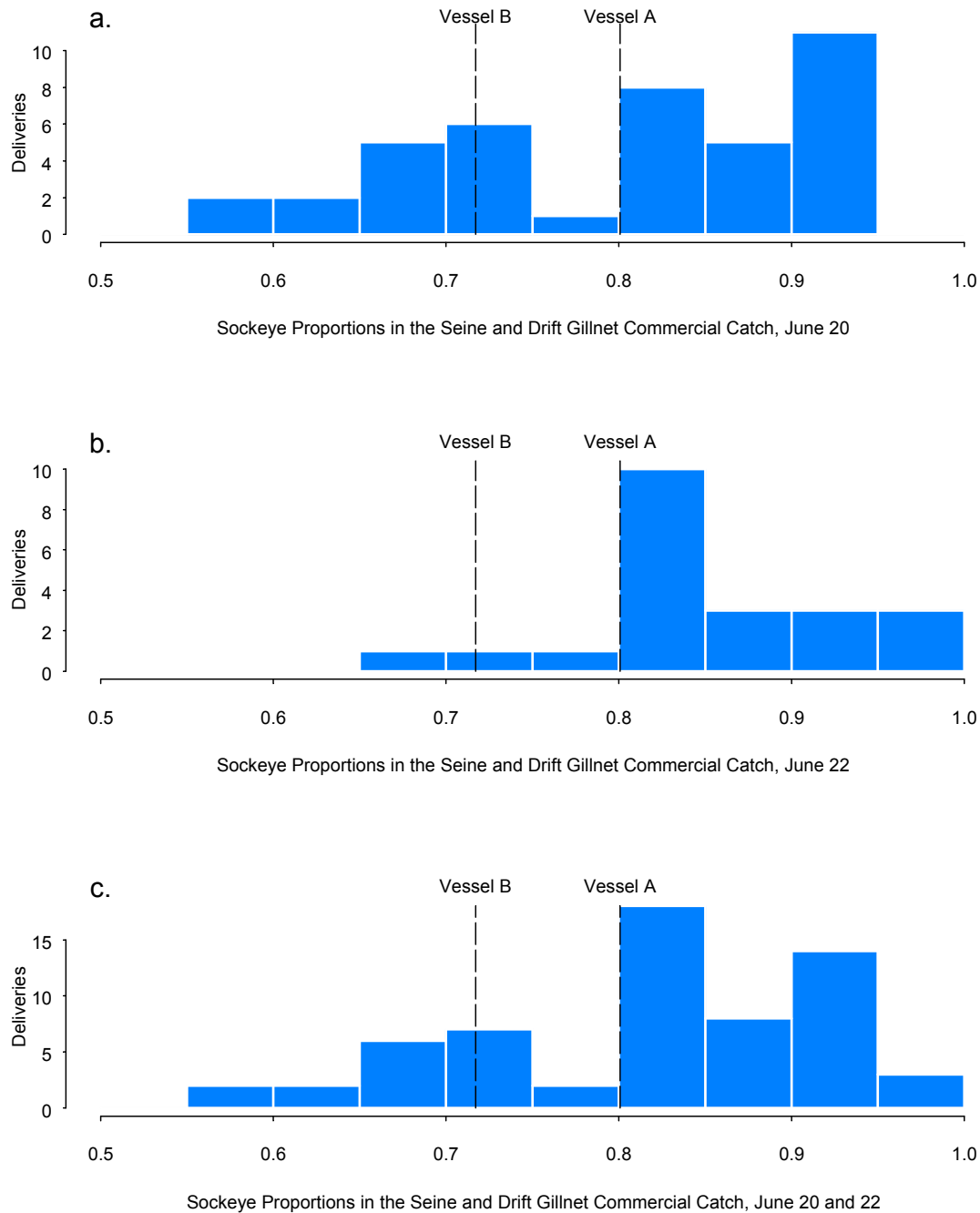


Figure 33.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Areas 284-90 and 285-20 combined, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

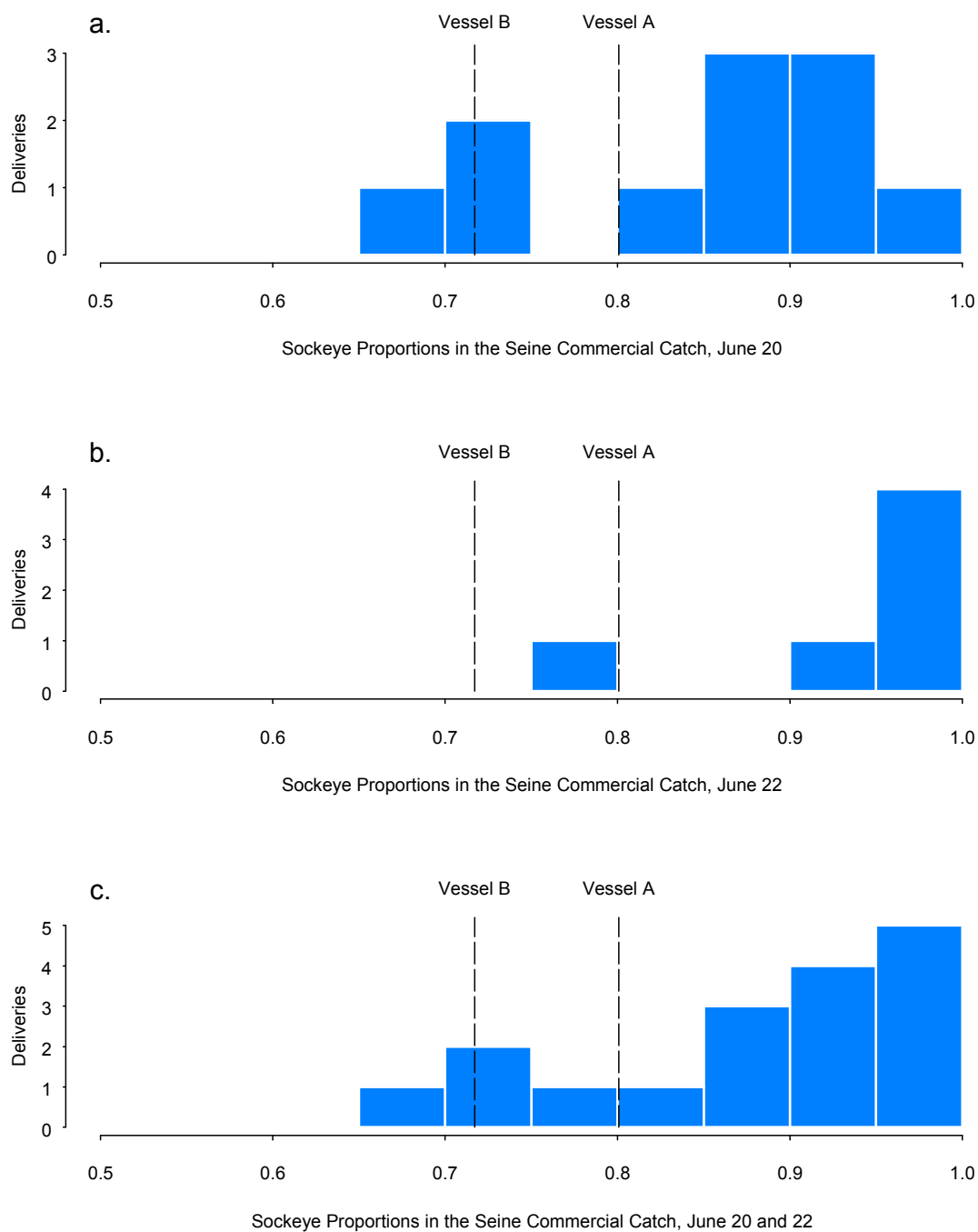


Figure 34.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

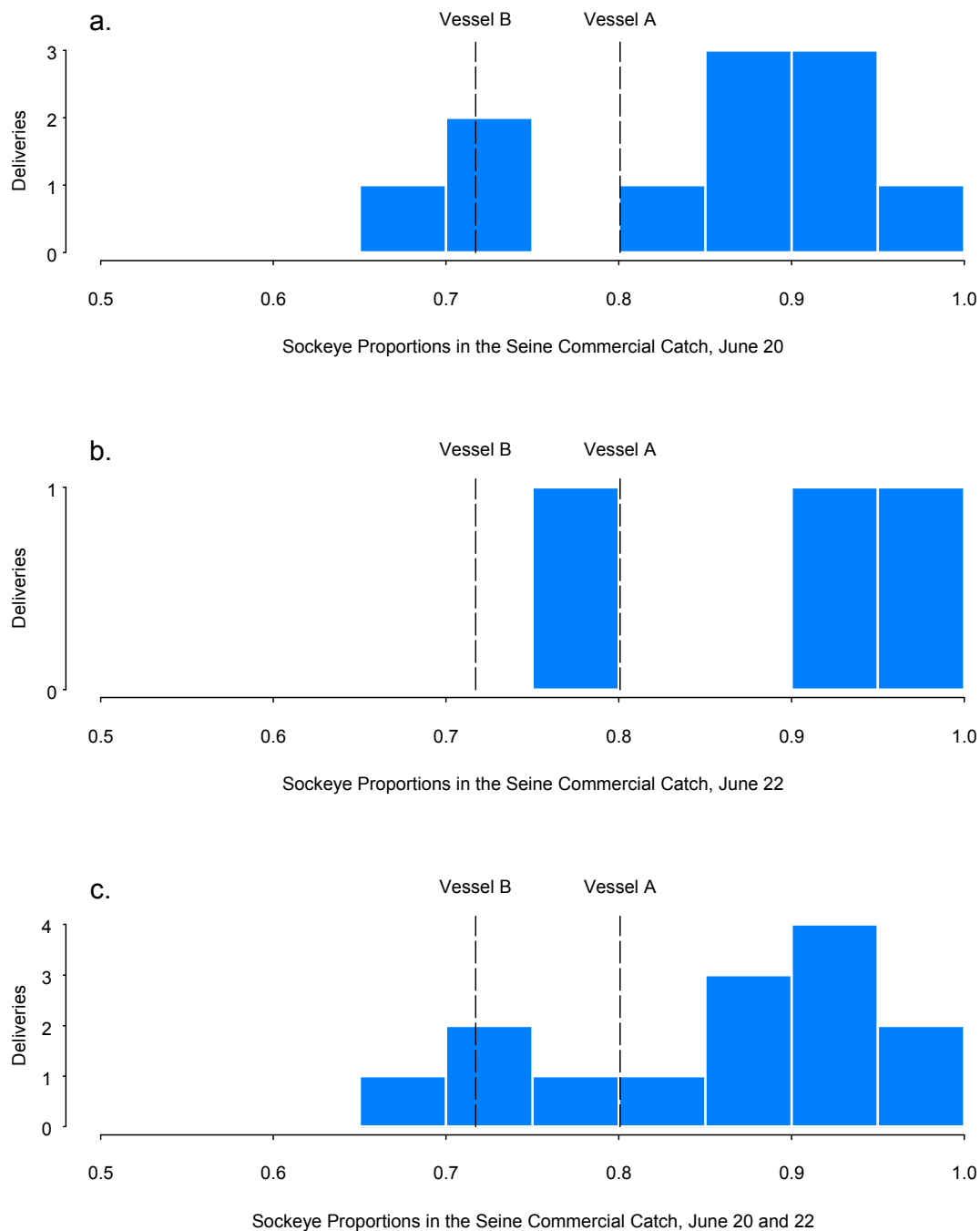


Figure 35.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

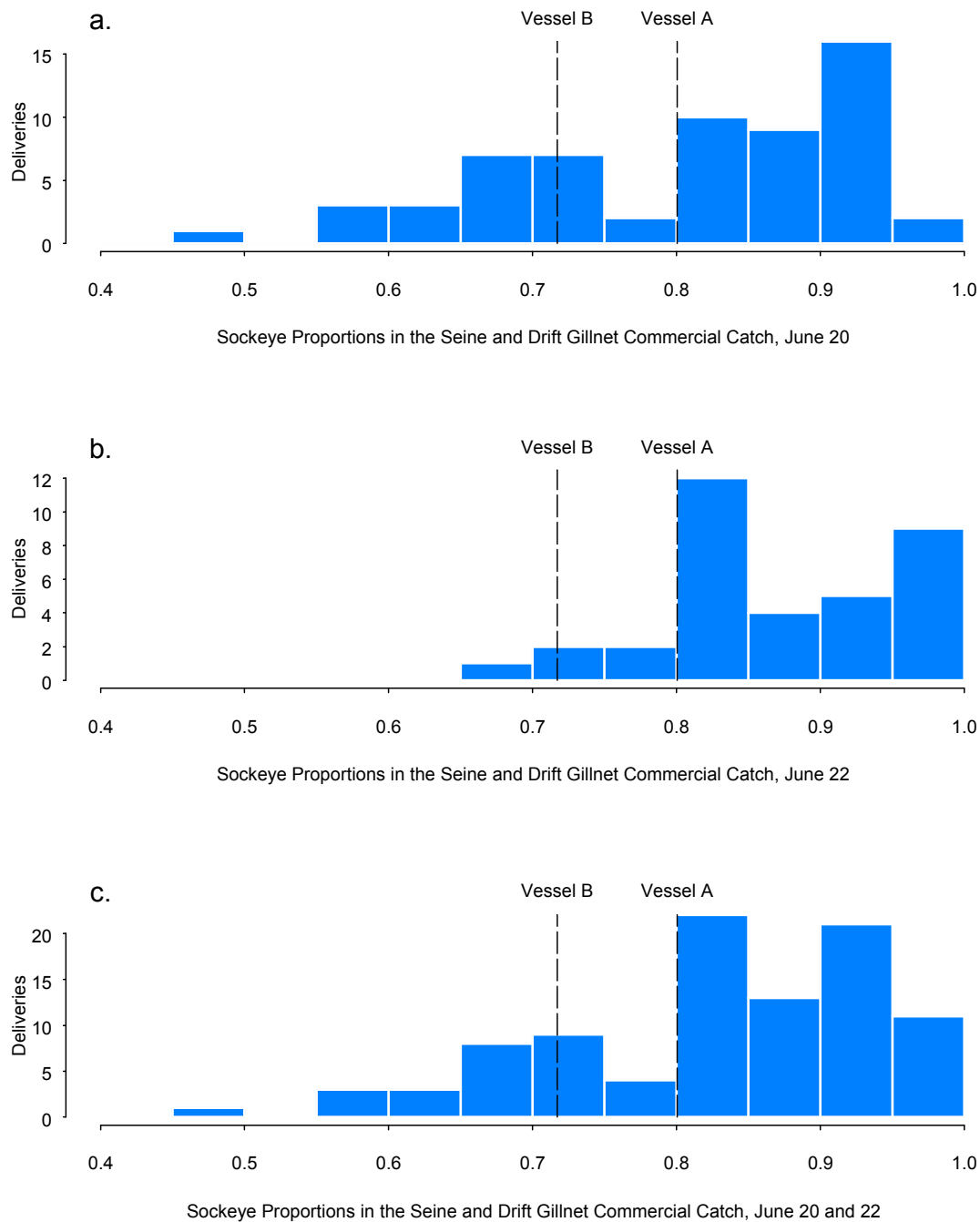


Figure 36.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

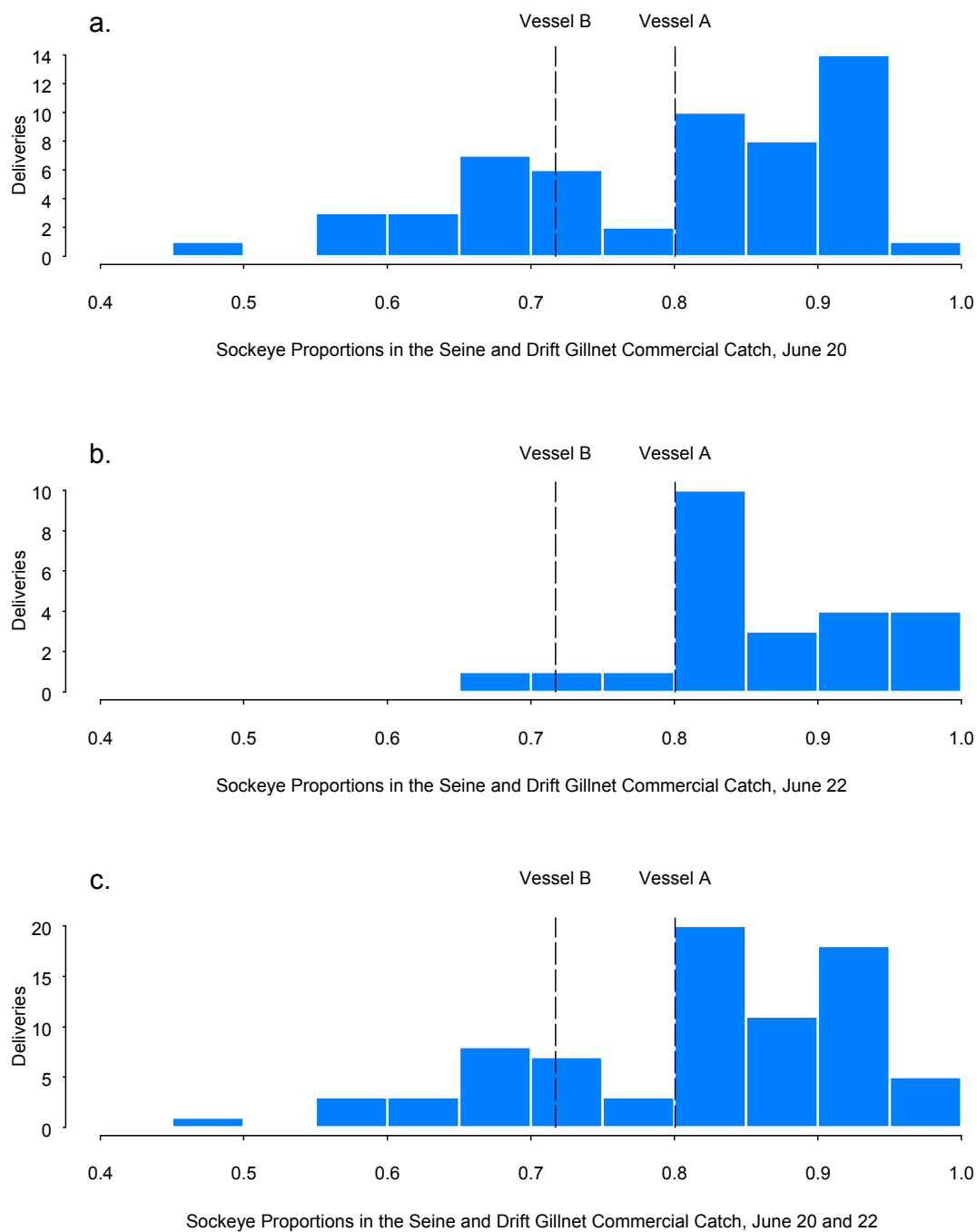


Figure 37.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

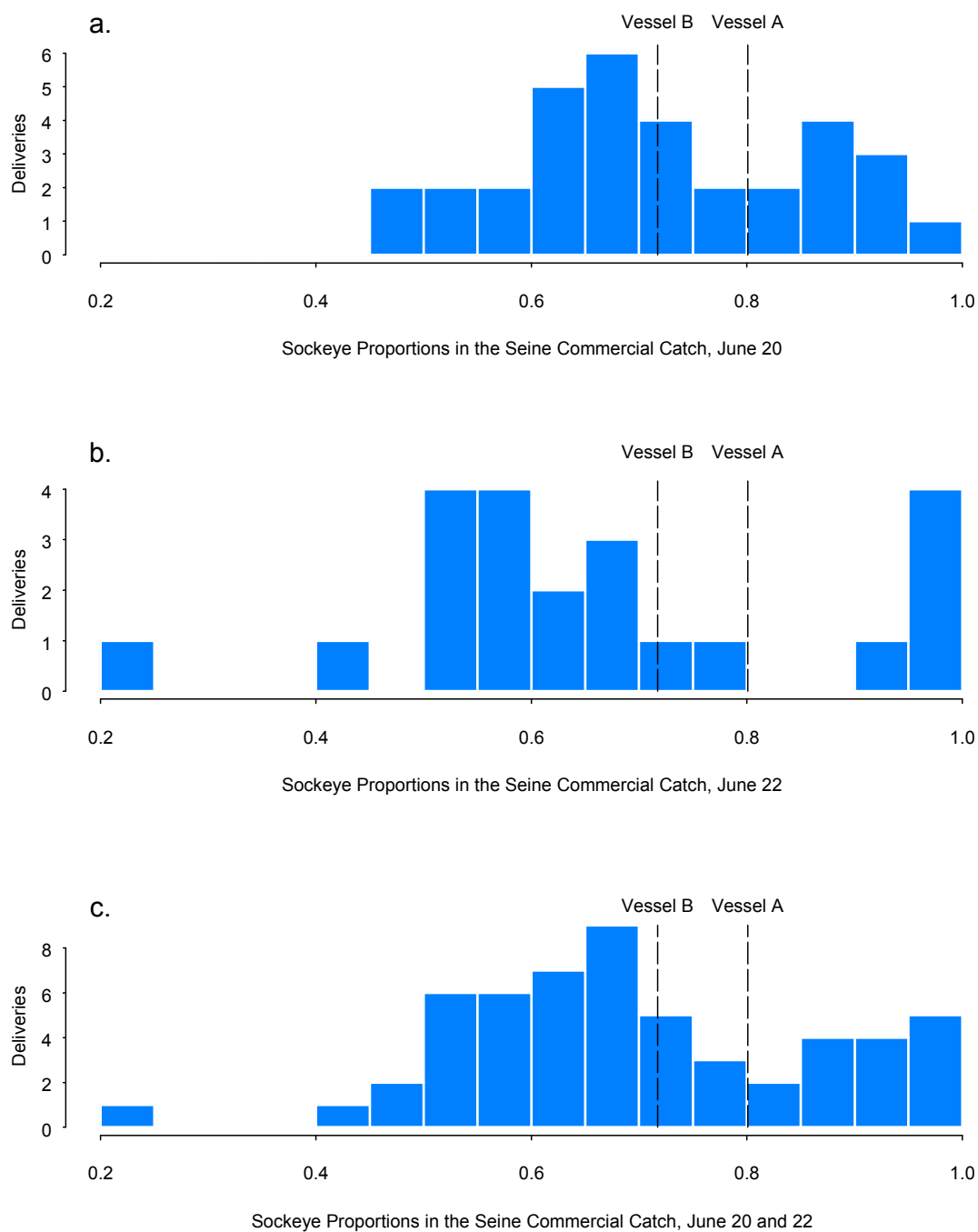


Figure 38.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

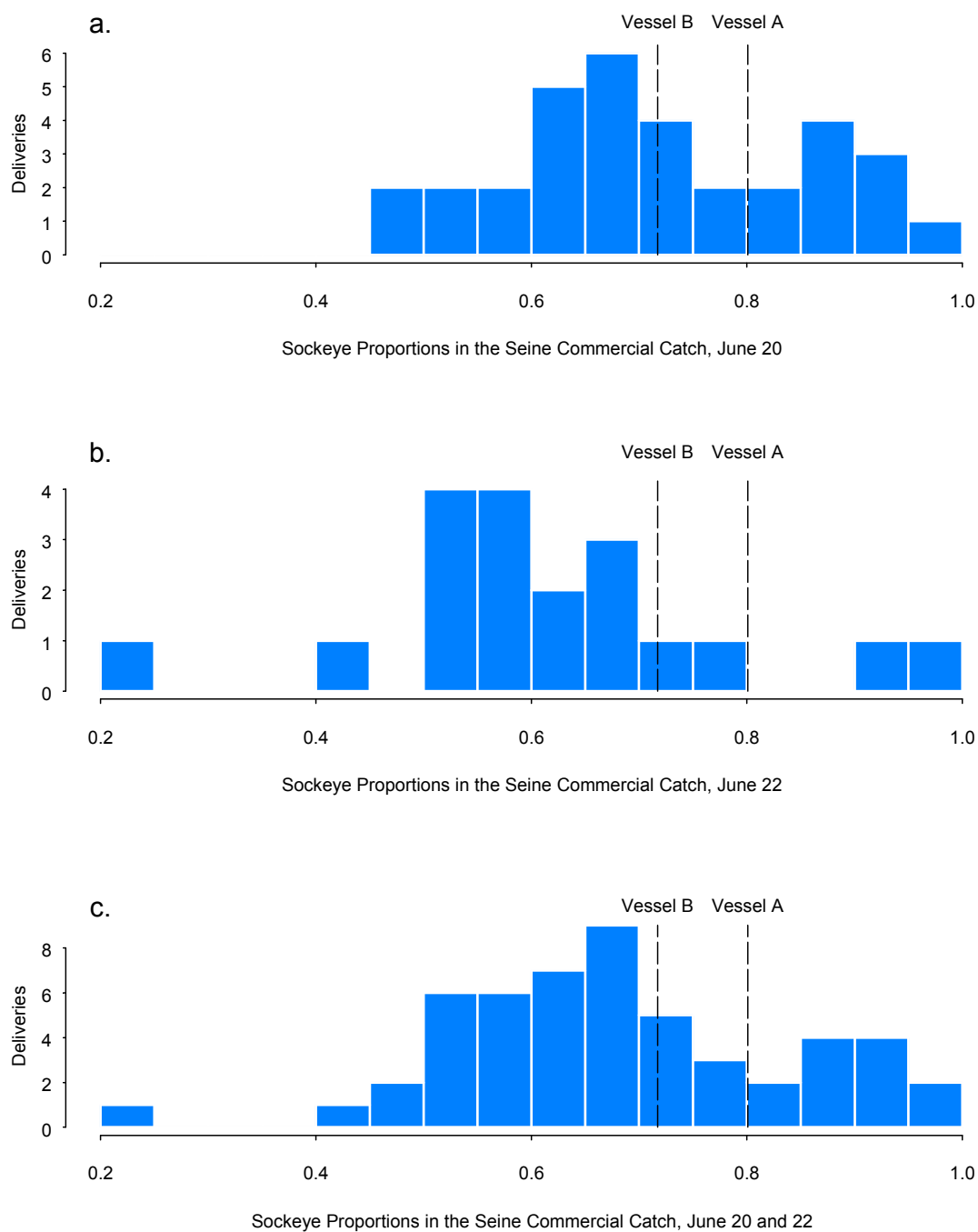


Figure 39.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

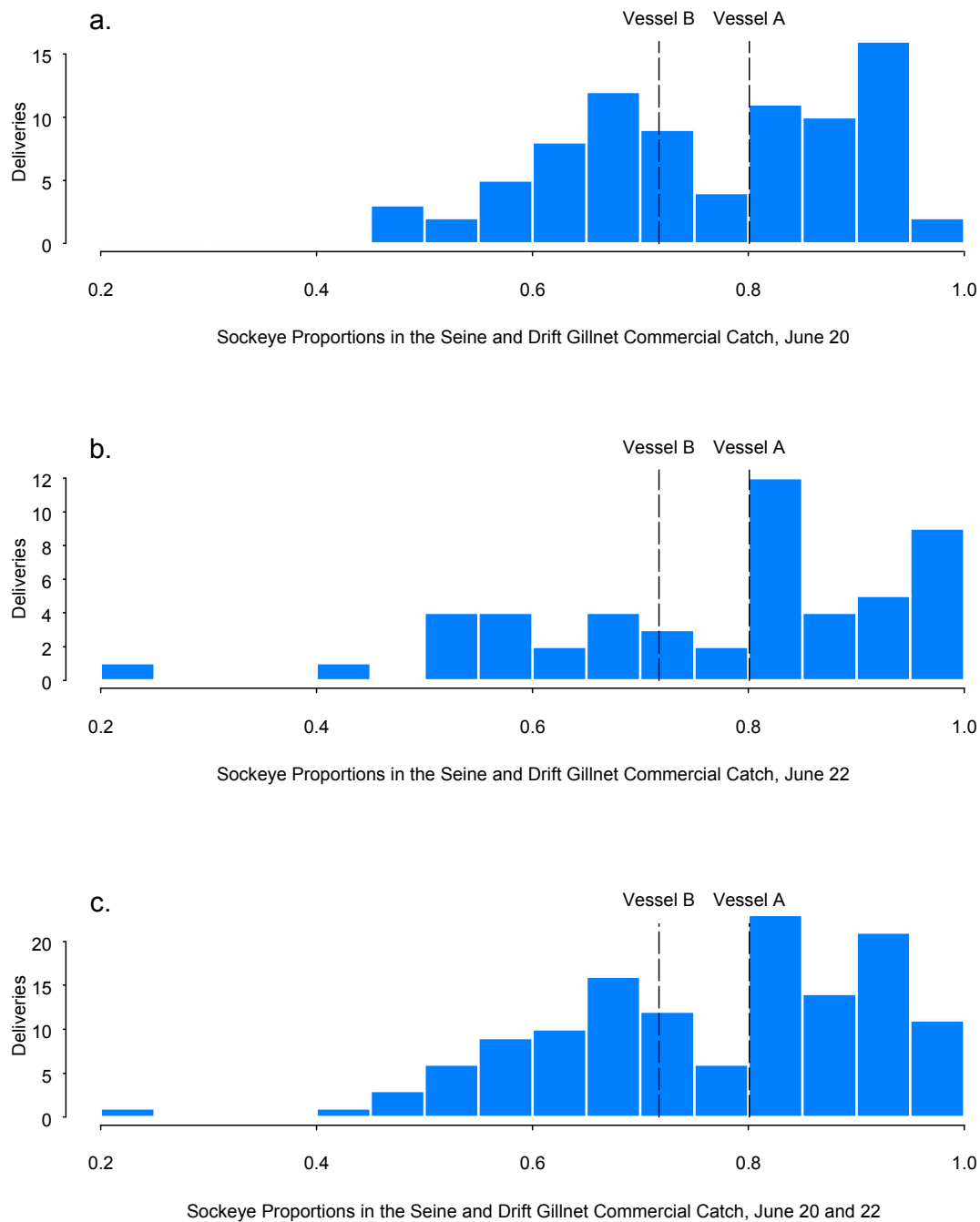


Figure 40.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

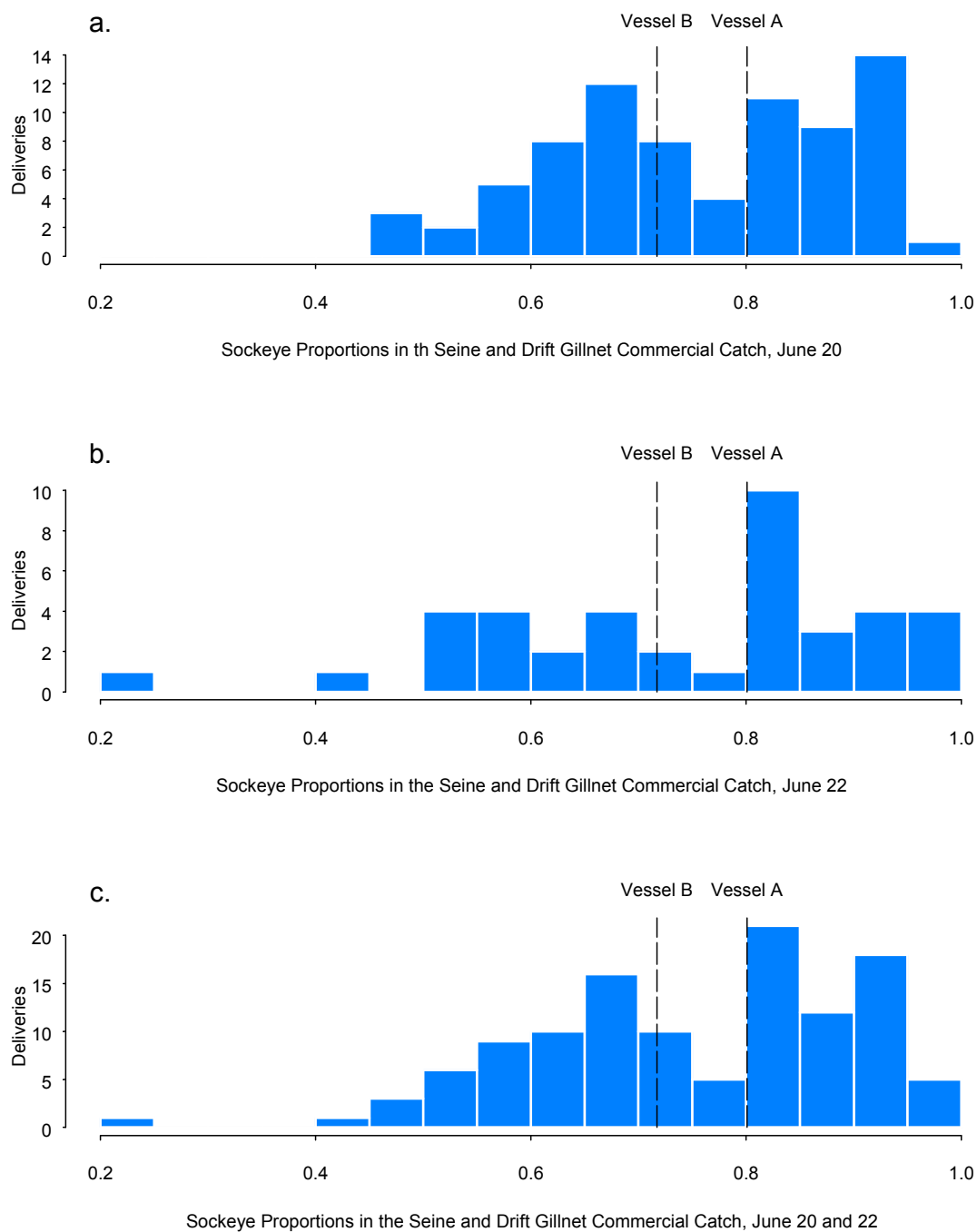


Figure 41.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 20, (b) June 22, and (c) June 20 and 22 combined, with sockeye proportions from the individual test fishery vessels on June 21, 2004.

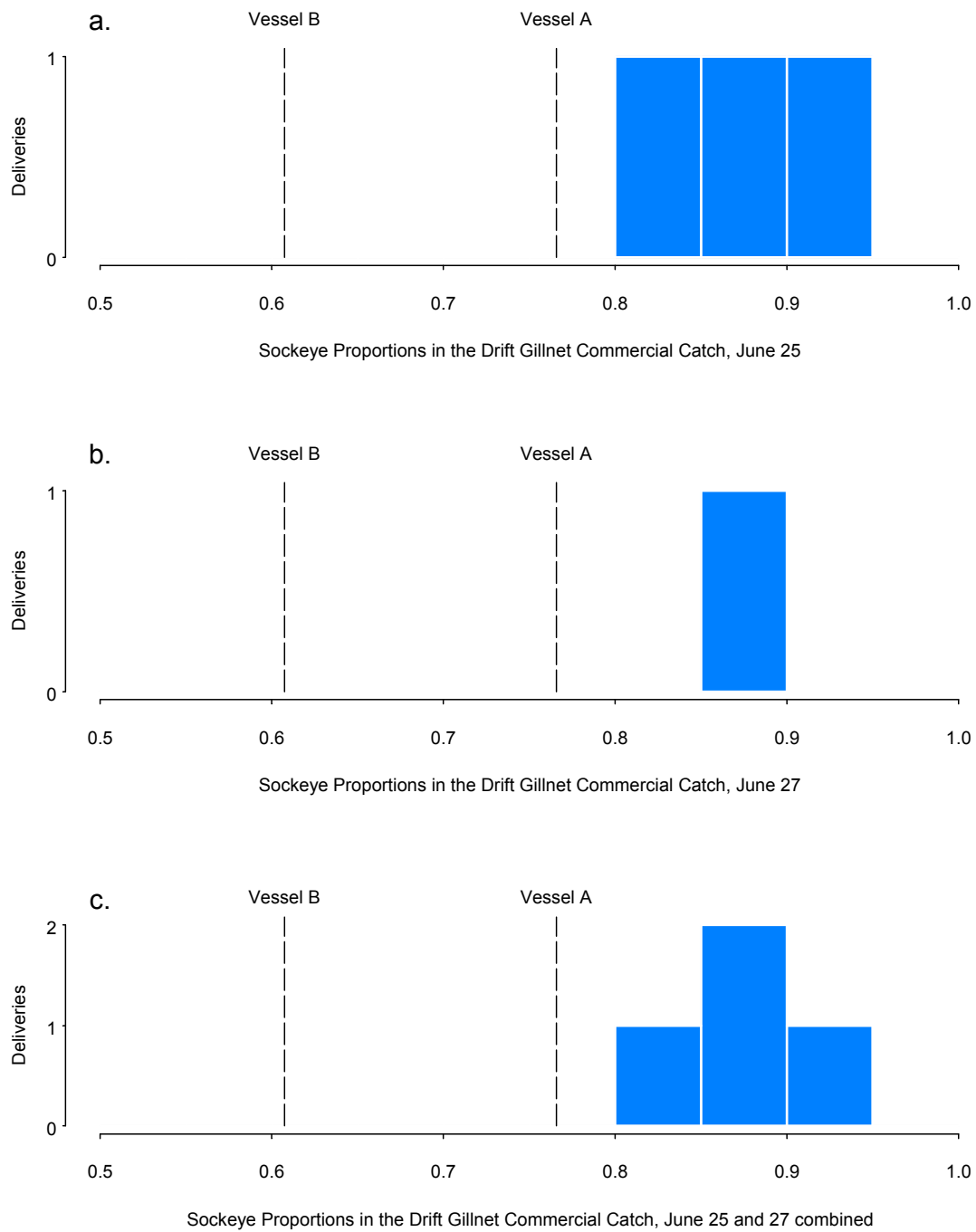


Figure 42.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial drift gillnet catch of ADF&G Statistical Area 284-90, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

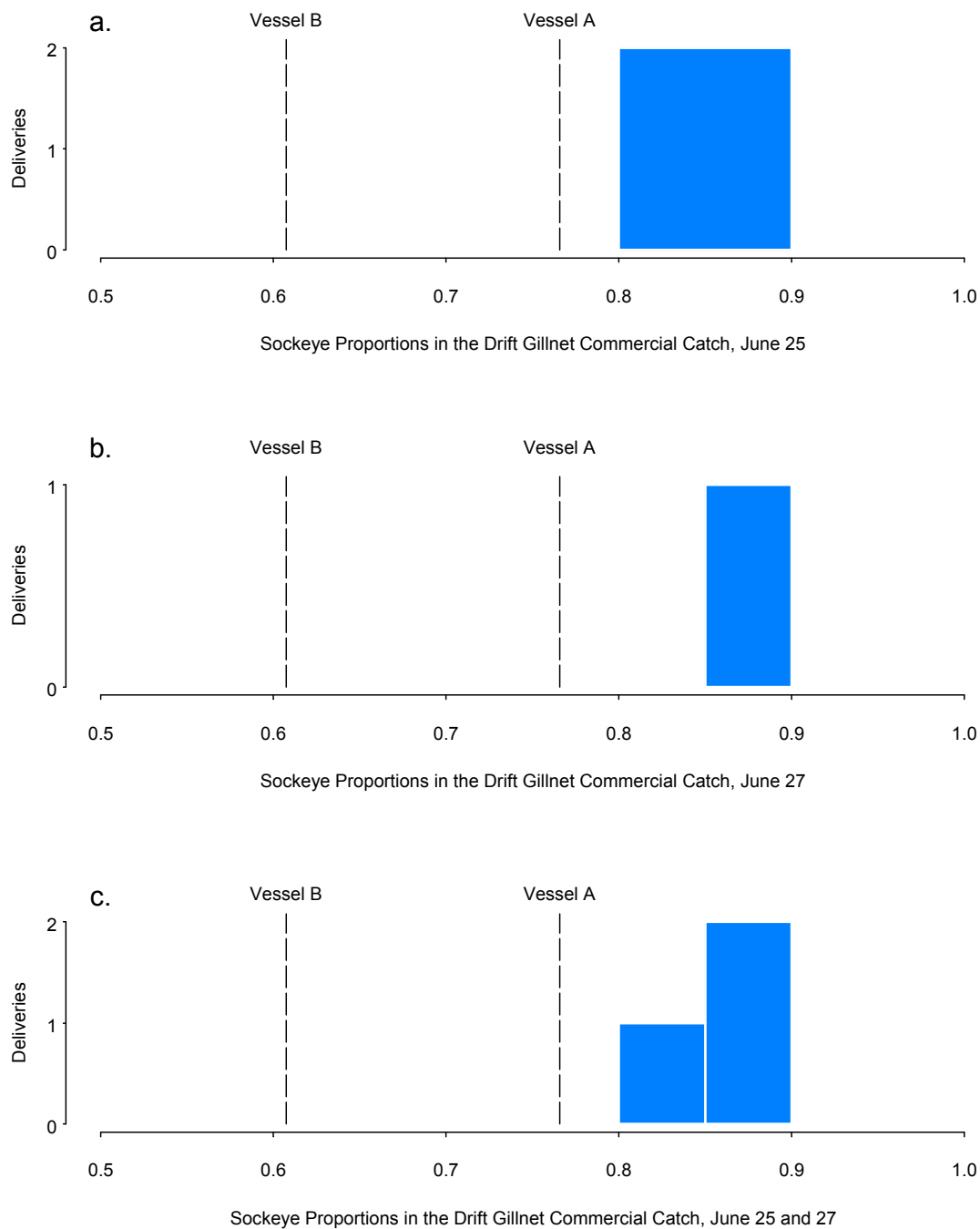


Figure 43.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial drift gillnet catch for vessels that caught 150 or more fish from ADF&G Statistical Area 284-90, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

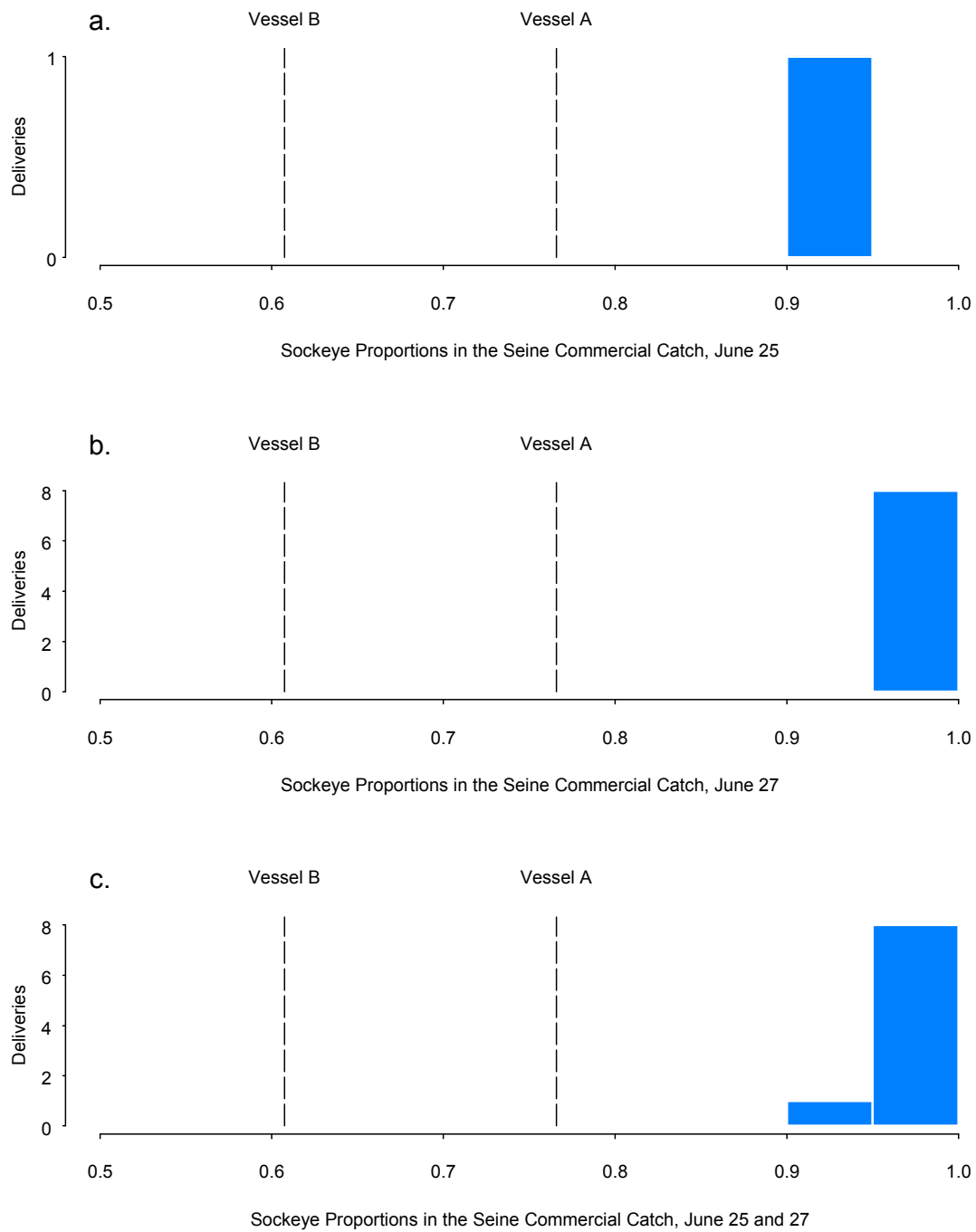


Figure 44.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak Area, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

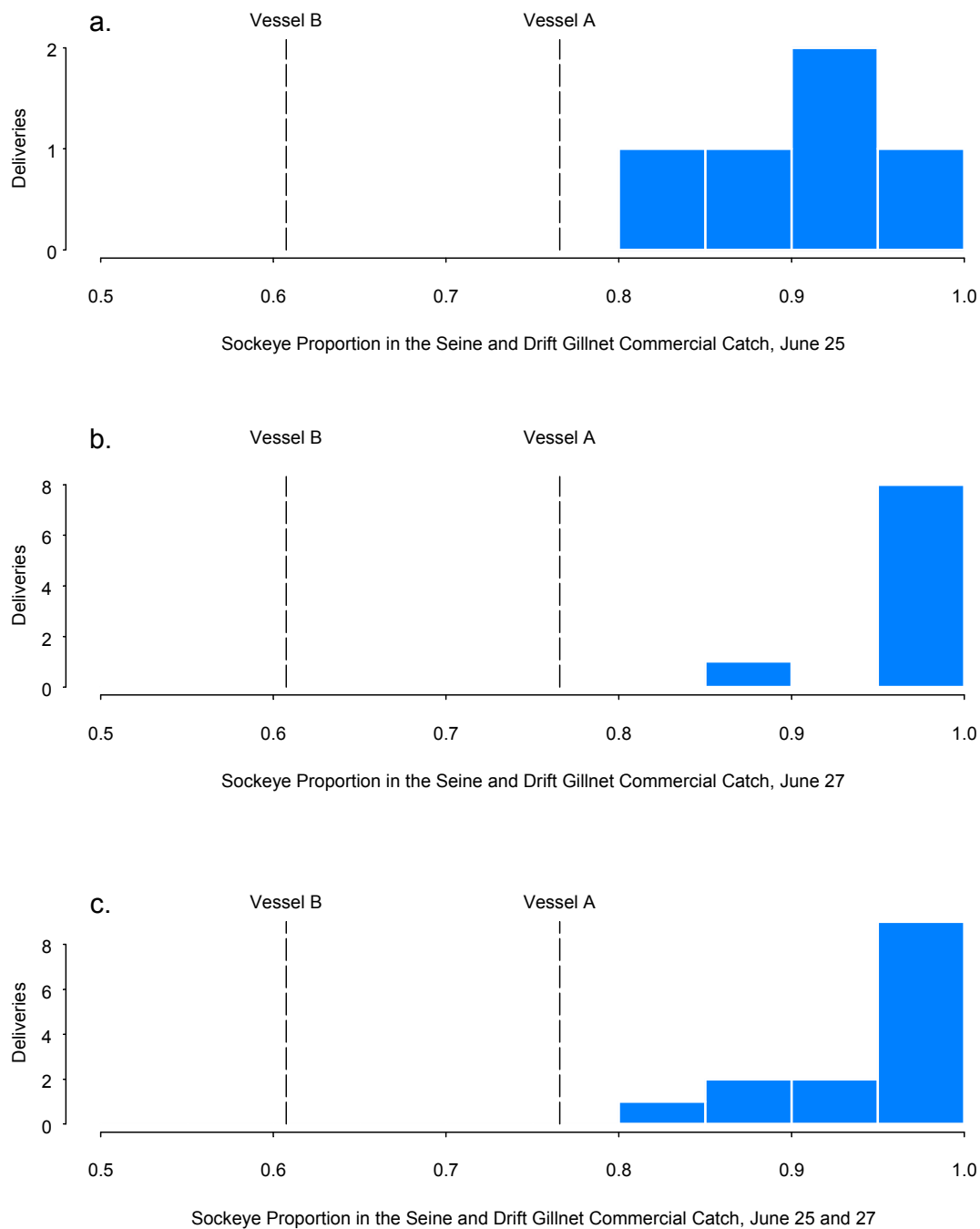


Figure 45.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak Area, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

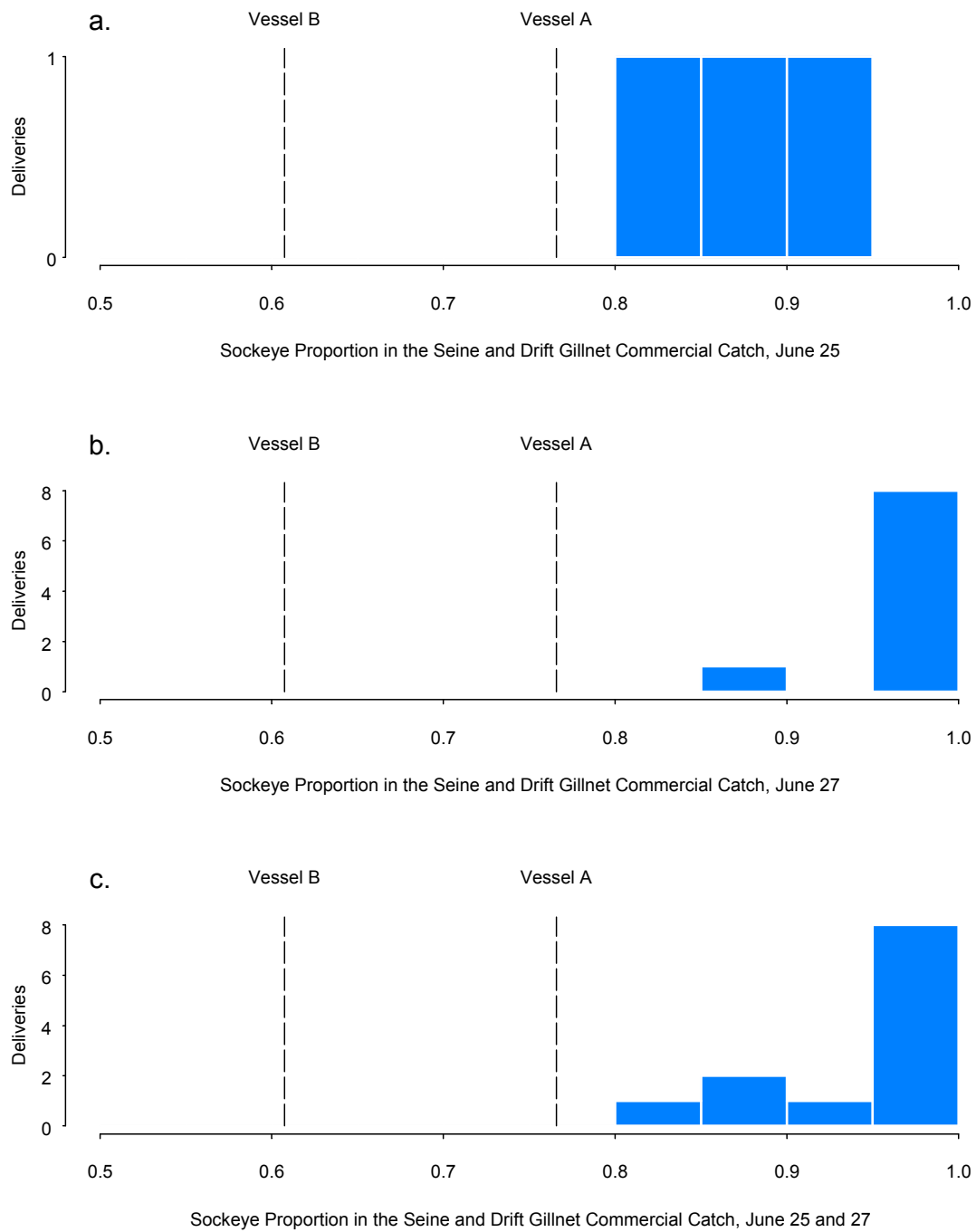


Figure 46.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak Area, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

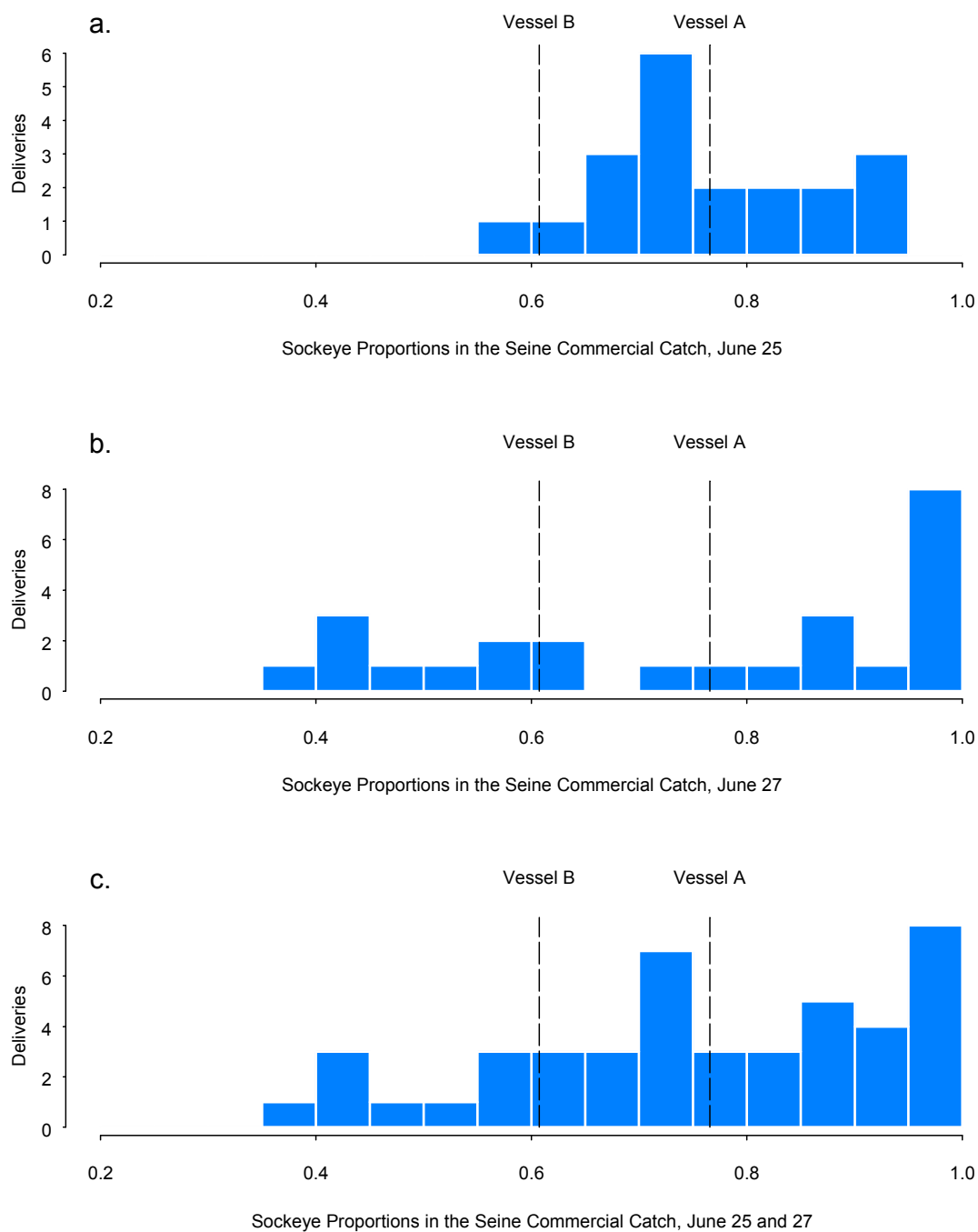


Figure 47.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch of the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

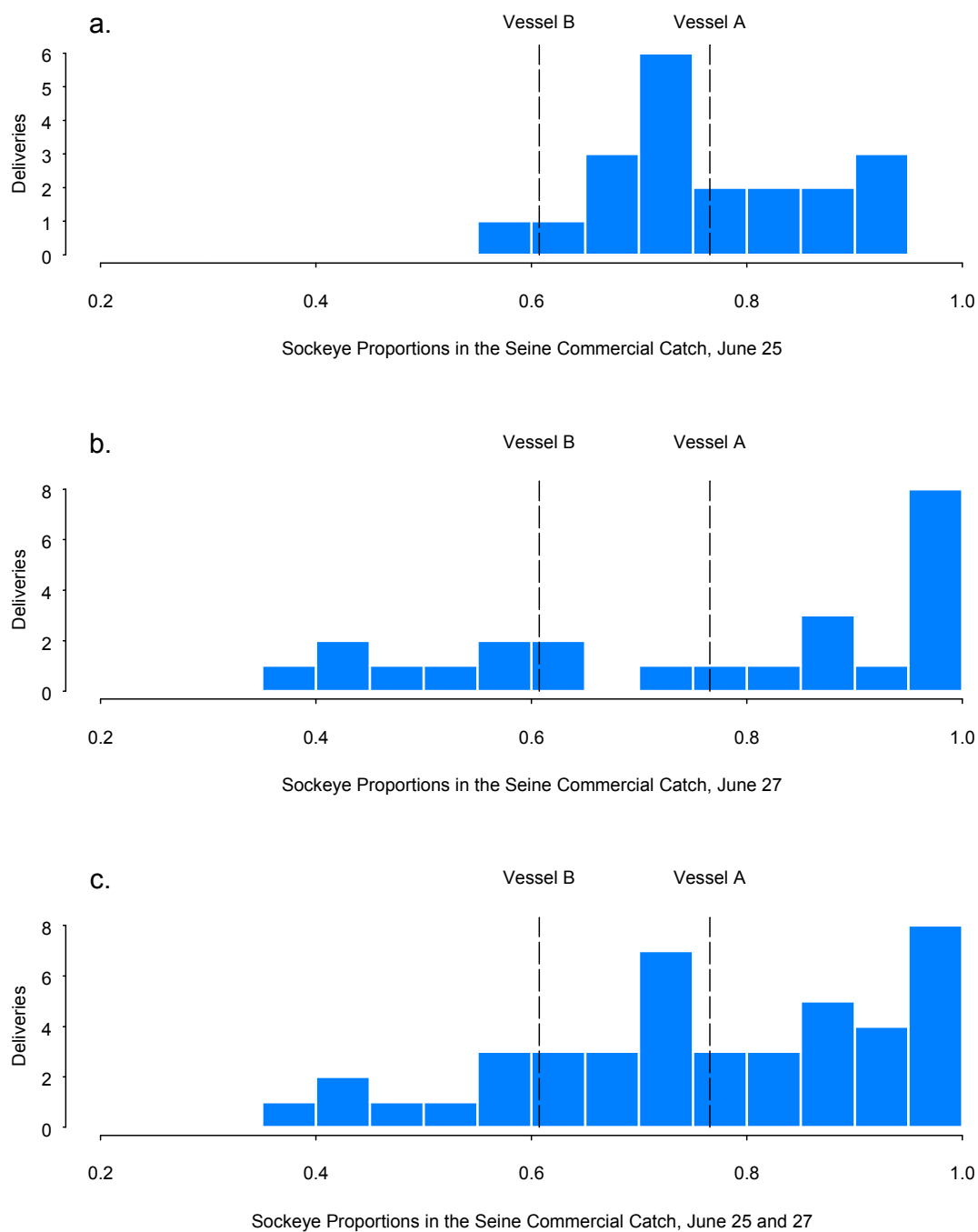


Figure 48.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

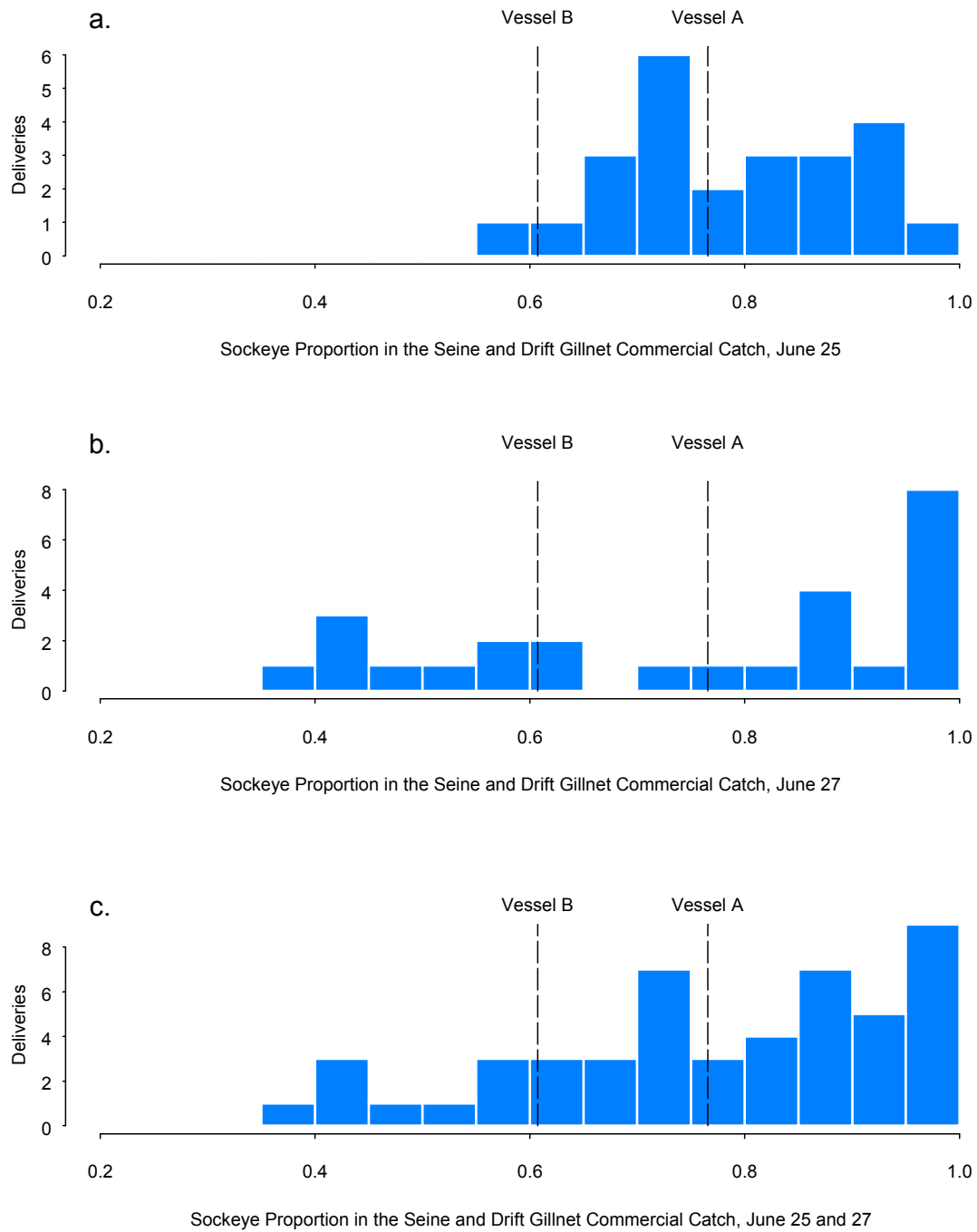


Figure 49.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch of the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

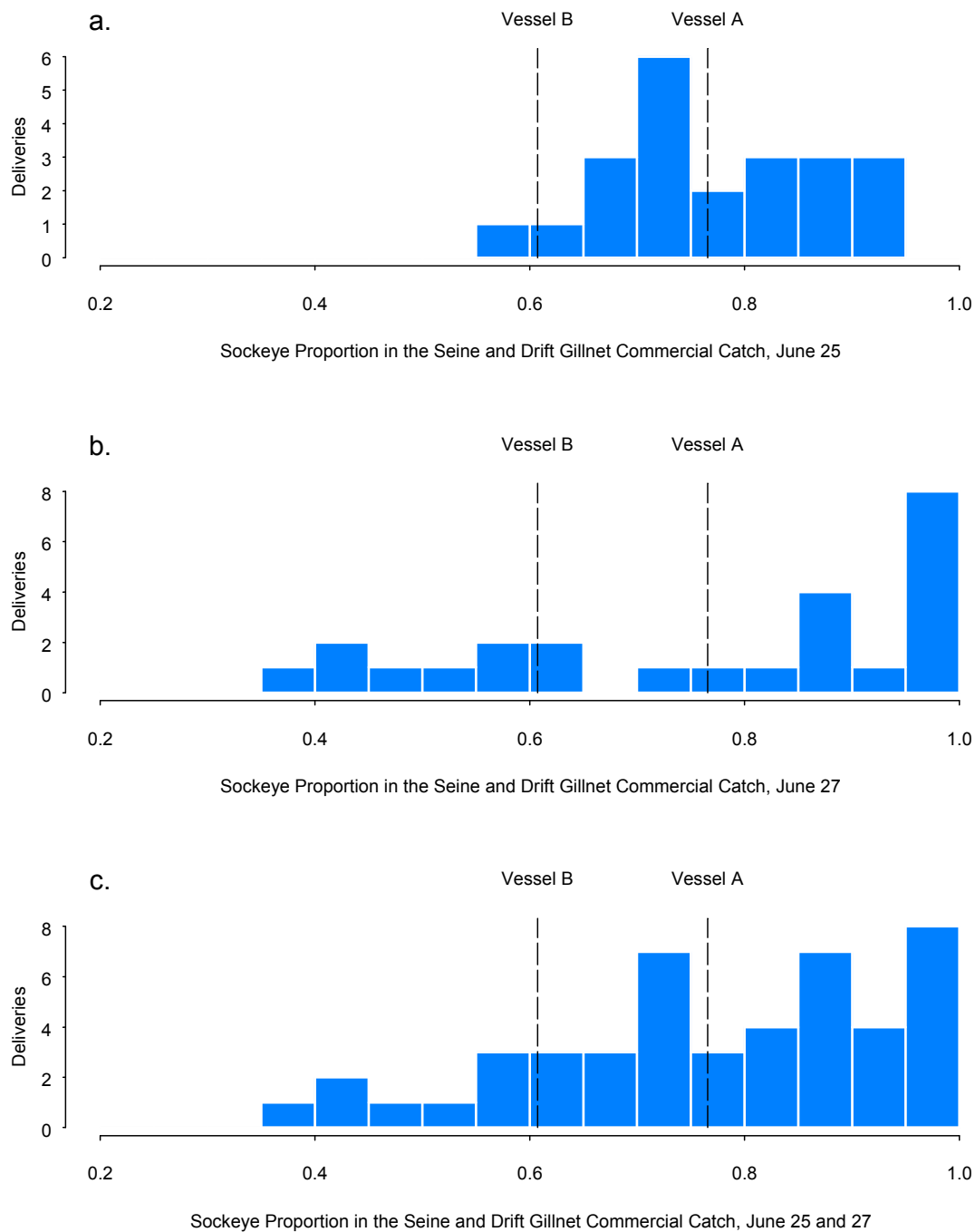


Figure 50.-Histograms of sockeye proportions reported on fish tickets for deliveries from the commercial seine and drift gillnet catch for vessels that caught 150 or more fish from the South Unimak and Shumagin Islands Areas, on (a) June 25, (b) June 27, and (c) June 25 and 27 combined, with sockeye proportions from the individual test fishery vessels on June 26, 2004.

APPENDIX A: SAMPLING FORM

Appendix A1.-Sampling form used during the South Unimak test fisheries in June 2004.

South Alaska Peninsula June Salmon Test Fishery Observation Form

Vessel Name: _____
Observer Name: _____
Date: _____

Set #	Fish Ticket Number	Location Name	GPS Location	Set Start Time	Set End Time	Total Set Time	Number of Sockeye Counted	Number of Chum Counted	S/C Ratio of Sample	Total Estimated Number of Fish Caught	Tide Stage	Weather and Sea Conditions	Comments
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

Test fishery observations:
Describe the method used to determine the number of salmon by species recorded on the fish ticket at the time of delivery.